Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

FINANCING ENERGY SELF-RELIANCE

Report EP 77-8

1977

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

ENERGY POLICY SECTOR

FINANCING ENERGY SELF-RELIANCE

A Background Paper to

An Energy Strategy for Canada: Policies for Self-Reliance

Report EP 77-8

1977

This report is a summary of a more comprehensive study of energy financing prepared for internal use by the Department of Energy, Mines and Resources.

Published by authority of
The Honourable Alastair Gillespie,
Minister of Energy, Mines and Resources,
Government of Canada

Cat. No.: M23-12/77-8

ISBN–0-662-01473-1

FOREWORD

> We have, within Canada, the people, the equipment, the expertise and the potential energy resources to reduce substantially our dependence on imported oil. We can do this by reducing the rate at which our energy requirements grow in the future, by substituting those energy forms which are in relative abundant supply in Canada for those that are not, by accelerating the search required to find new oil and natural gas—to convert the potential of our undiscovered energy resources to proved reserves from which our energy needs can be supplied[1].

After a number of decades in which energy was relatively cheap and abundant, Canada—along with the other industrialized nations of the world—has in very recent years found itself being propelled into a radically new era.

There is an imminent danger within the next 10 to 15 years that world demand for petroleum will begin to outrun the supply available from the exporting nations. At the same time, there is every prospect that the cost of finding, developing and marketing new sources of energy from domestic and other sources in order to fill the gap could be significantly higher than even the greatly increased costs being experienced today.

By comparison with most other industrialized nations, Canada is well-endowed with actual and potential energy resources. Nevertheless, the results of on-going exploration in the conventional and frontier areas have led to a progressive reduction in estimated reserves of oil and natural gas deposits. At the same time, there has been a substantial increase in the costs of finding and developing not only those petroleum reserves which do exist, but most other sources of energy, as well.

Faced with the prospect of being compelled to rely on massively increased volumes of imported oil from sources abroad that could be curtailed for political, economic or physical reasons, the Canadian government in 1976 adopted a national energy strategy of self-reliance. The keystone of that strategy is a series of policies aimed at fostering both the increased supply and conservation of energy so as to ensure that by 1985 and thereafter Canada's net oil imports do not exceed one-third of total consumption.

Even with rigorous conservation, it is estimated that over the years from 1976 to 1990 Canada will have to invest some $180 billion—based on 1975 currency values—to provide the increased energy supplies that will be urgently required to meet the needs of a growing economy and expanding population.

---

[1]From the Foreword by Hon. Alastair Gillespie, Minister of Energy, Mines and Resources, *An Energy Strategy for Canada,* Policies for Self-Reliance, Department of Energy, Mines and Resources, Ottawa (1976).

[2]All financial estimates in this report are in terms of 1975 dollars.

possibility of some delay in such a recovery. It was found that this would not substantially affect our energy investment program. Indeed, these projects will themselves be instrumental in providing the basis for an economic upturn. It should be noted, however, that if the Canadian economy, in spite of new energy investments combined with anticyclical measures, fails to regain its vigour, the conclusions reached by this paper regarding the financing of our energy program will not hold. Their financibility would then become much more difficult and would likely be dependent on export of a significant proportion of the additional energy produced.

The investment scenarios discussed here do not include research and development costs, which are normally absorbed by operating expenses, in excess of historical trends. It may be that research for more energy efficient transport and industrial process technologies will require significant investments, but these will likely be carried out by other than the energy supply industries and as such they will be beyond the scope of this paper.

Finally, the projections of this study do not envisage a major role for such energy sources as coal gasification, liquefaction, and other exotic alternatives. They most probably will play an increasing and eventually major role. Although expenditures within this study's time-frame are difficult to predict, they appear to be relatively small and mostly devoted to research.

This paper addresses major issues at both the industry and national aggregate levels. At the national level the major question is what kind of adjustments, both real and financial, will Canada require to absorb the projected $180 billion of energy investment between 1976 and 1990. At the industry level, the major issues are the adequacy of cash flows and availability of suitable external funds to finance expected expenditures, and how the structure of each industry may change in response to these factors. Our major conclusions concerning these issues are:

1. Canada will be able to absorb the $180 billion of energy investment forecast to take place by 1990, but some changes in the structure of the economy will occur. There will be some relative decline in the requirements of certain sectors, which will be roughly in proportion to the increased needs of the energy sector, with the result that no increased reliance on foreign borrowing should be necessary on balance.

2. The structural changes required will, in broad terms, involve an increased share of GNP being absorbed by energy investment, and a corresponding increase in the importance of energy borrowing. Financial institutions will devote a larger share of their portfolios to energy sector debt instruments.

3. The petroleum sector will decrease its reliance on external funds from an average of 27% in the 1960-74 period to less than 10% between 1976 and 1990. Despite this, new instruments may have to be created to transfer funds within

the sector, and debt financing may be quite important for specific projects such as oil sands. The use of external funds by the electric utility industry will not fall below the historical level of 70% but it may climb to as high as 90% depending on growth rates and pricing policies.

4. In the petroleum sector, new instruments may be required to organize financial capital for non-conventional oil developments. In the electrical utility sector, traditional vehicles may be appropriate if prices rise or growth is restrained. However, if utilities maintain historical growth and pricing patterns, some form of federal participation may be required.

5. In electricity and energy mining, no major changes in industry structure are envisaged. In petroleum, there may be a tendency for increased concentration of power among the major corporations. Some government response may be necessary to ensure a continuing role for the small independent companies.

6. Governments may have to play a role in the financing of certain developments, but the critical factor will remain the long-term economic viability of the projects undertaken.

CONTENTS

Chapter 1. INTRODUCTION

Background and policy framework

The federal government energy policy paper entitled *An Energy Strategy for Canada* established the policy objective of self-reliance which is aimed at supplying Canadian energy requirements from domestic resources to the greatest extent practical. The paper outlined as critical to the realization of self-reliance several key factors including:

- the acceleration of exploration for and development of energy resources,
- improved energy conservation, and
- switching of demand from scarce energy sources to those which are more abundant.

The Energy Strategy target of moving Canadian petroleum prices towards international levels is a critical factor for the development of additional resources. At the current real price of international crude, the development of oil sands, heavy oils and enhanced recovery techniques might not be economic for the private sector. If the real price of international crude continues to rise, these resources could offer a clear route to reduced dependence on foreign oil. The prospect of acceptable profits would attract investment funds to these activities without further government involvement.

At least until international prices are attained, there is a continuing need for government policies to encourage these developments in a time frame which is consistent with Canada's demand for energy resources. At the same time, the government's action should not disrupt those activities where the market is efficiently allocating resources. There is, in addition, an obvious limit on the premium that we can afford as a country to pay in order to achieve the goal of self-reliance. Government policy is aimed at striking a proper balance in view of the danger that investments which are made attractive only through the provision of significant incentives could result in an inefficient allocation of resources, which in turn could increase costs in the economy generally and decrease its international competitiveness.

The following sections provide an overview of the changing supply picture and the policies which will encourage the reduction of our dependence on foreign sources of energy.

The changing petroleum supply picture

Despite recent indications of major oil finds in western Canada, and the possibility of an oil discovery in the Beaufort Sea, there have not recently been

any major additions to Canada's proved oil reserves. In 1973, the mean estimate of resource availability was 99 billion barrels of oil and 782 trillion cubic feet of gas, which might be ultimately recoverable. More recent estimates suggest that our remaining resources are in the order of 30 billion barrels of oil and 277 trillion cubic feet of gas[1]. Furthermore, not all of these resources have been found and the percentage which is recoverable will depend very much on economic and technological conditions.

The oil sands and heavy oil deposits are very promising in terms of supply potential, but long lead times and logistics preclude more than two or three more Syncrude-size plants coming on stream before the late eighties. This is apart from the problems relating to the viability of such projects from a financial point of view, a subject to be addressed in more detail later.

Up to this point the discussion has focussed on oil. Turning to other energy commodities, the picture brightens considerably. Canada is a large exporter of natural gas and, because of our commitments, will remain so for the next 12 years. The limited successes in the frontier areas have, to date, been natural gas discoveries. Proved reserves may soon be sufficient to justify development and transportation systems. Availability of coal, uranium and hydroelectricity will allow for some growth in production, although the extent to which production of coal and uranium can be usefully increased is, at present, limited by the capacity of the economy to effectively utilize these fuels. Over the long run, as the structure of the economy changes, their contribution could become more important.

The focus of this paper is on policies directed at increasing domestic supplies and on the financing difficulties which may inhibit rapid growth in supply. The investment and attendant supply scenarios of this study do not contemplate drastic changes in the demand picture resulting from conservation and interfuel substitution. However, the result of these efforts might reduce Canada's dependence on oil imports below the 1/3 target. In such an event, financing energy self-reliance would become that much less difficult because of the resulting reduction in resources required to import fuel from abroad.

The kind of options open to Canada as a nation in the near and medium term will depend critically on two factors:

- expected international prices and attendant uncertainty; and
- the cost structure of new Canadian resources.

International prices and investment uncertainty

Despite the experience of the OPEC-inspired price acceleration over the past four years, the possibility of some erosion of the existing real price of oil

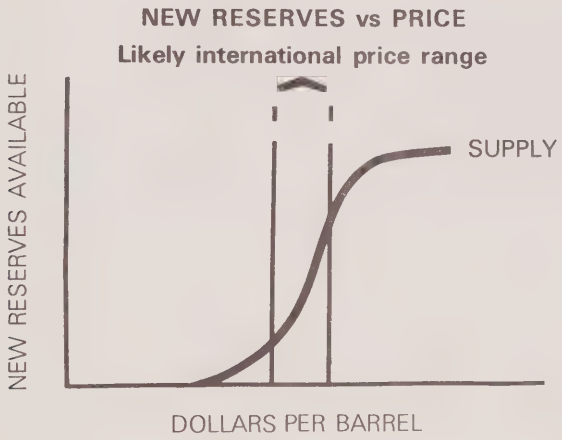
---

[1] *Oil and Natural Gas Resources of Canada*, 1976. Report EP 77-1. Energy, Mines and Resources.

cannot be dismissed. This is of particular concern to Canada, for it would take only a mild decline in real prices to make most of our new sources of oil and gas uneconomic.

It is important to remember that over the longer term a petroleum shortage is faced by the world only at a given price level. At prices in the vicinity of $20 per barrel, in terms of 1975 dollars[2], a new tier of oil supplies becomes economic. This includes oil shales, oil sands, heavy oils, tertiary recovery systems and coal gasification. Furthermore, many petroleum deposits in remote or offshore areas which are uneconomic at present would become recoverable. While significant lead times are required to bring these projects on stream, there can be little doubt that knowledge of their potential existence instills some caution in OPEC pricing decisions.

The importance of OPEC pricing policy can be shown in the following diagram. It summarizes the dilemma of Canadian petroleum development in a qualitative way.



The main messages of this rather symbolic chart are that:

- below a cost range represented by present international prices (give or take about 10%) the availability of new reserves is quite small, would decline over time and dependence on limited OPEC supplies would increase; and
- at a relatively narrow price range perhaps somewhat above current OPEC levels a relatively large supply of resources could become economic.

Most synthetic petroleum reserves on the North American continent, large known reserves accessible by enhanced recovery methods, and considerable frontier resources could become economically viable at that notional narrow band of higher prices.

---

[2]Constant 1975 dollars are used throughout this report.

Policy tools and their limitations

Government intervention in the economy can be justified to offset or overcome developments in the market which are contrary to the public interest. This can occur for a variety of reasons, including external developments affecting costs and prices that are unrelated to a particular industry, differing perceptions of risk, imperfect information, or because of global investment strategies of multinational companies which conflict with national interests. Within recent years, governments have intervened extensively in energy markets in an effort to correct some of the imbalances created by the national and international upheaval in the energy sector. Nevertheless, there is a consensus that the market system—operating within the framework of certain constraints and incentives—generally continues to be the most efficient mechanism for the allocation of scarce resources.

There are many instruments which are available to the government to induce greater production of higher cost domestic energy resources. Used properly, these can stimulate energy projects which can reduce the uncertainties faced by Canadians at minimal cost. However, because of the two-sided nature of the risk faced by Canada, there is a danger that market intervention can be carried too far. Government intervention to provide self-reliance may involve the development of relatively high cost energy resources, which could impose real costs on the economy no matter what tools are used. It is imperative to keep these costs in mind when examining methods of achieving an optimal balance between the costs of intervention and the risks of excessive dependence on imports.

Differential taxation

The federal government has traditionally given the petroleum industry favourable tax treatment as compared with other sectors of the economy. However, it is easy to lose sight of the costs which can accompany excessive fiscal leniency in one sector of the economy. The argument is often made that even if indigenous energy costs a bit more than imported oil, at least the money would be spent in Canada, and ease balance of payments problems. Since there are indications that a tax-free price of about $13 a barrel in 1975 dollars could yield an attractive rate of return on oil sands, the question is often asked: "Why can't government forego taxes completely and let private industry get on with the job of production?"

There is a more than superficial appeal to these arguments, but closer examination reveals that they do not consider a number of important factors. First, it is well to remember that the federal government has only limited room to manœuvre in the area of resource taxation. At present most of Canada's known oil and gas resources are located on provincial land. It is the provinces which collect the bulk of the taxes on this industry. For example, from 1947 to 1972, total corporate income tax paid by the petroleum industry amounted to $840

million of which about $700 million went to the federal government. Over the same period, total transfers from the industry to the provinces amounted to roughly $5 billion. While both are small in relation to the more than $20 billion gross revenues realized and reflect the development incentives the industry received, they also show the relative fiscal importance of the different levels of government.

That the federal government is continuing to provide incentives to seek out new supplies is illustrated by present fiscal arrangements. Out of a $1 increase in the price of a barrel of oil, the federal government would collect only three cents if 50¢ of the increased price were reinvested in exploration by the industry. If this exploration took place in the form of expensive wells, the federal collection could be almost eliminated. Were none of the price increase to be reinvested, the federal take would climb to 27 cents. While different tax regimes have been applied to different industries by governments over the years, there is no reason why all industries should not be expected to carry a fair and appropriate share of the burden of taxation. This is particularly so in the case of a depleting, non-renewable public resource such as oil or natural gas.

The notion that tax-free Canadian oil could displace tax-free imported oil is also a bit misleading. It is true that no taxes are paid on the $13 price of a barrel of imported oil. But this transaction puts $13 Canadian in the hands of foreigners. In the normal course of events these funds are returned to Canada by way of investment or by purchasing exports, both of which tend to increase Canadian income. Many of our exports are energy intensive. To the extent that these have a petroleum content, Canada would be subsidizing consumers in the rest of the world by levying no fiscal burden and/or continuing to hold domestic prices below their opportunity cost. Pricing oil at less than the real cost of the factors of production required to produce it is clearly inefficient in terms of resource allocation. It holds factors of production in uses where their lower levels of productivity are masked. The essential point is that Canadians can only do themselves long-run damage by not adjusting their productive activities to the new realities of higher priced energy resources.

Financial incentives

Financial incentives may simply improve the return on an investment. Alternatively, they may alter its economics in more fundamental ways, for example, by altering its term or risk structure, and each type of scheme would probably have different effects on capital markets. With the former type of assistance, the characteristics of investment in oil and gas—from a private viewpoint—would not change. It would remain an activity where the risks are high but so are the prospective returns. It is likely that funds earned by the oil industry, and also the funds of other risk-seeking investors would be attracted to these ventures.

Another approach would be to reduce the risk of investment to the private sector. Schemes such as this would appeal to the type of investor who would

normally buy the bonds of utilities or governments, rather than the high rollers who invest in the oil industry.

Experience indicates that a substantial flow of funds into either short or long-term securities may take place in response to changes in interest rate differentials. For individual investors, however, the shift is generally not large in relation to total investments because most have a "preferred habitat" for their funds. As a rule, this is dictated by a desire to match the term and risk structure of their assets to that of their liabilities. Small changes in relative interest rates could induce investors to reshuffle a portion of their portfolios, but not to completely restructure them.

If the risk for the investor were sufficiently reduced, the additional petroleum capital required to develop presently marginal resources would not come from all sectors of the capital market, but from one particular sector—that which has traditionally invested in utility and government bond issues. Since the external financing requirements of the utility industry are themselves growing at a faster rate than the capital market as a whole, the result would likely be much higher than usual interest rate premiums at this end of the market.

The difficulties discussed so far pertain to oil and gas. There are also problems which may be encountered by electric utilities. Costs are escalating dramatically. This is partly the result of the increase in capital costs generally, and partly because of the much larger scale of many new generating units being built—together with high costs of transmission networks from distant load centres. Since petroleum is an important fuel in the generation of power in some parts of Canada, oil price increases have also aggravated this situation. At the same time, this increase in price has tended to switch expansion plans away from less capital intensive thermal generation to more capital intensive nuclear and hydro stations. This has created a shortage of funds for the utilities at a time when regulatory authorities are reluctant to authorize further increases in electricity prices.

Achieving an optimal allocation of resources is a finely balanced process and pursuing a policy of self-reliance raises many potential problems. How much of an insurance premium should Canada be willing to pay for domestic rather than foreign energy? What is the appropriate division of the economic gains and losses which this policy might cause among the different sectors of Canadian society? To what extent should interfuel substitution be encouraged beyond what would be produced by the operation of market forces alone? These contentious issues were discussed in *An Energy Strategy for Canada* and some will be examined at greater length in forthcoming background papers to that study. The present work addresses a different problem: How will future Canadian energy requirements be financed?

Framework for financing: Capital expenditure scenarios

What is being contemplated is a large structural change in the energy sector of the economy. This will require massive investments in the near and medium term. Estimates of these requirements, developed later in this chapter, are in the order of $180 billion between 1976 and 1990.

Since the events of the past few years have illustrated the difficulty of attempting to forecast energy development, this paper uses a flexible approach which explicitly recognizes the uncertainties of energy matters. Two scenarios are discussed which cover a range of possible energy developments, and their financial implications are assessed in some detail. This type of analysis cannot predict highly specific financial problems which may develop in the future but by its very nature it can cover a wide range of possibilities.

This paper analyzes in depth the high price scenario of *The Energy Strategy for Canada,* called Scenario A, as well as a new Scenario C. The more comprehensive paper, for internal departmental use, includes a third scenario (B).

Scenarios and capital requirements

Scenario A is most optimistic with respect to frontier hydrocarbon supplies assuming by 1990 6 billion cubic feet per day (Bcf/day) of gas and 500 thousand barrels daily of oil from the frontier as well as 440 thousand barrels daily of synthetic and heavy oil. Three frontier pipelines are projected and electricity demand is assumed to grow at 5% resulting in a total energy capital bill of $181 billion.

Scenario C is less optimistic with respect to frontier development. It assumes that no oil and reduced supplies of gas are available from the frontier and specifically no Mackenzie Delta gas, although oil and gas production from conventional reserves is the same in both cases. Only one frontier gas pipeline is required. Electricity demand continues its historical growth of 7% per year and oil sands and heavy oil must be relied upon to supply one million barrels daily by 1990. Total capital requirements also come to around $180 billion under this scenario.

The capital requirements in scenarios "A" and "C" are by coincidence similar in aggregate, although there are substantial differences in composition and in the development patterns of the various energy industries. These scenarios were chosen to bracket a range of likely developments and *are not intended as specific forecasts.* It is now likely, for example, that supplies of Mackenzie Delta gas will be lower than assumed in Scenario A, but higher than the zero level assumed in Scenario C. Correspondingly, pipeline expenditures are likely to be

somewhat overstated in Scenario A, and understated in Scenario C. However, the thrust of the analysis is not altered by these factors.

Other capital requirements associated with marketing and distribution, refining and energy mining are assumed to be the same in both cases. Tables 1-1 and 1-2 which follow summarize the salient supply and capital requirements assumptions in each of the scenarios.

Plan of the study

The remainder of this study examines the implications of financing these energy scenarios. Chapter 2 examines the macroeconomic framework within which the energy investments will occur, and examines the linkages between energy financing and the rest of the economy. The projected demand for capital by the energy sector, and by other sectors of the economy are compared with domestic capital market capacity, and the sensitivity of the results to changes in macroeconomic trends is discussed. Chapter 3 looks at the financing problems which may arise in the petroleum industry, and in particular in certain sectors of it. The role and future adequacy of traditional financing instruments is examined, and suggestions for policies to cope with potential financial problems which may arise are made. Chapter 4 summarizes the financial challenges facing the pipeline industries over the next 15 years. Chapter 5 examines the atmosphere for financing electricity development and investigates the relationship between electricity prices and the demands which the industry may place on capital markets. Some possible methods of relieving anticipated pressures associated with electricity financing are offered. Chapter 6 deals with the financing of energy mining. Finally Chapter 7 reviews and summarizes the main conclusions of this work.

Table 1-1

Canadian Energy Supply Scenarios

Scenario A

Year	Oil			Gas				Coal	Electricity
	Thousands of barrels daily			Millions of cubic feet per day				Millions of tons per year	Capacity in megawatts
	Conventional[1]	Oil sands and heavy oils	Frontier	Conventional[1]	Mackenzie Delta	Arctic Islands	East Coast		
1975	1 737	43		6 900				27.7	59 540
1980	1 472	153		8 150				44.9	72 400
1985	1 136	274		8 565	1 650	1 200	150	80.5	97 800
1990	736	444	500	6 475	2 250	3 500	250	118.1	125 200

Scenario C

Year	Oil			Gas				Coal	Electricity
	Thousands of barrels daily			Millions of cubic feet per day				Millions of tons per year	Capacity in megawatts
	Conventional[1]	Oil sands and heavy oils	Frontier	Conventional[1]	Mackenzie Delta	Arctic Islands	East Coast		
1975	1 737	43		6 900				27.7	59 540
1980	1 472	258		8 150				44.9	79 100
1985	1 136	432		8 565		1 200	150	80.5	111 100
1990	736	1 012		6 475		3 500	250	118.1	151 800

[1] These figures refer to producibility rather than actual production.

Table 1-2

Canadian Energy Capital Expenditure Scenarios

Millions of 1975 Dollars

Scenario A

Year	Petroleum exploration and development	Oil sands and heavy oils	Refining	Natural gas and oil marketing and distribution	Pipelines	Coal	Electric power	Total energy
1976-80	10 580	2 995	1 430	2 510	5 710	780	21 700	45 705
1981-85	15 450	2 275	1 035	3 080	19 205	1 485	32 300	74 830
1986-90	14 240	305	1 340	3 455	3 045	990	37 200	60 575
Total	40 270	5 575	3 805	9 045	27 960	3 255	91 200	181 110

Scenario C

Year	Petroleum exploration and development	Oil sands and heavy oils	Refining	Natural gas and oil marketing and distribution	Pipelines	Coal	Electric power	Total energy
1976-80	8 320	2 345	1 430	2 510	2 445	780	24 400	42 230
1981-85	8 700	6 775	1 035	3 080	11 465	1 485	36 190	68 730
1986-90	6 260	5 650	1 340	3 455	2 810	990	49 410	69 915
Total	23 280	14 770	3 805	9 045	16 720	3 255	110 000	180 875

Chapter 2. MACROECONOMIC AND CAPITAL MARKET ADJUSTMENTS

Introduction

The CANDIDE econometric model was used to analyze the implications for the Canadian economy of the $180 billion of energy capital expenditures which are anticipated between now and 1990. This enables us to address the question of reallocation of real resources—manpower, equipment and so on—within the same framework as is used to evaluate the changes in financial markets which the new pattern of resource allocations may require.

The basic conclusions of this analysis are that the energy investments should not impose unmanageable strains on the economy. On the financial side, the share of energy borrowing will be quite different from the historical pattern but the transition should be accomplished smoothly as financial institutions readjust their portfolios to accord with the new pattern of real resource allocation.

Capacity of the Canadian economy

The model predicts an average annual increase in real GNP of 4.3% during the 1970-1985 period, and of 3% during the following period, 1986-1990. Early in the eighties labour markets should become quite tight with the pressure easing off and unemployment stabilizing at an average level of about 5.5% between 1986-1990. The inflation rate is expected to decrease gradually until it stabilizes at about 5% per annum, with a temporary increase in the crucial years 1984-1985 reflecting the strains created by peak energy investment.

Savings and investment

Table 2-1, and Figure 2-1 show the forecast of total investment in relation to forecast GNP. Total investment as a percentage of GNP is expected to increase from 24.5% to 26.4% between 1977 and 1984, and then to decline in the eighties. Within this total, the share of residential construction and government investment is expected to decline from 9.1% of GNP to 7.2%, while the share of business investment—including the energy sector—will climb from 14.5% of GNP in 1975 to a maximum of 18.1% in 1984. An increase of this magnitude can certainly be accommodated by reductions in the shares of other investment expenditures, or consumption, or by increased foreign borrowings.

Total savings will of course have to increase to match the increase in total investment. Savings by the household sector will grow roughly in proportion to GNP, and savings by business enterprises are expected to increase by a somewhat

Table 2-1

Summary of Macroeconomic Indicators Canada 1976-1990

Millions of 1975 Dollars

	1	2	3	4	5	6*	7	8
Year	GNP	Government fixed capital formation	Residential construction	Scenario A Energy investment amounts	Other gross fixed capital formation	Total capital formation	Total domestic savings	Energy as % total investment
1976	165 000	6 400	8 600	7 460	16 560	40 880	35 500	18.2
1977	175 000	6 700	8 790	7 795	17 645	42 860	38 190	18.1
1978	185 000	6 980	8 920	8 670	20 060	46 735	41 820	18.5
1979	195 000	7 290	9 000	10 170	21 795	50 245	44 520	20.2
1980	203 000	7 560	8 920	11 610	22 375	51 990	46 680	22.3
1981	210 000	7 810	8 610	12 605	21 330	51 560	47 380	24.4
1982	217 000	8 070	8 390	13 235	22 095	53 165	49 810	24.8
1983	230 000	8 340	8 570	14 850	24 560	58 410	54 590	25.4
1984	242 000	8 620	8 690	17 575	26 180	63 770	59 310	27.5
1985	250 000	8 870	9 290	16 565	27 415	64 010	60 720	25.8
1986	256 000	9 080	9 030	12 795	28 760	60 845	60 030	21.0
1987	264 000	9 330	8 660	12 130	29 420	60 860	61 860	19.9
1988	272 000	9 560	8 110	11 415	30 770	61 480	63 200	18.5
1989	280 000	9 970	7 490	11 695	32 290	63 210	65 320	18.5
1990	289 000	10 330	7 030	12 540	33 645	65 600	68 110	19.1

*Total capital formation is greater than the sum of 2 + 3 + 5 because of the addition of inventories in the total figure.

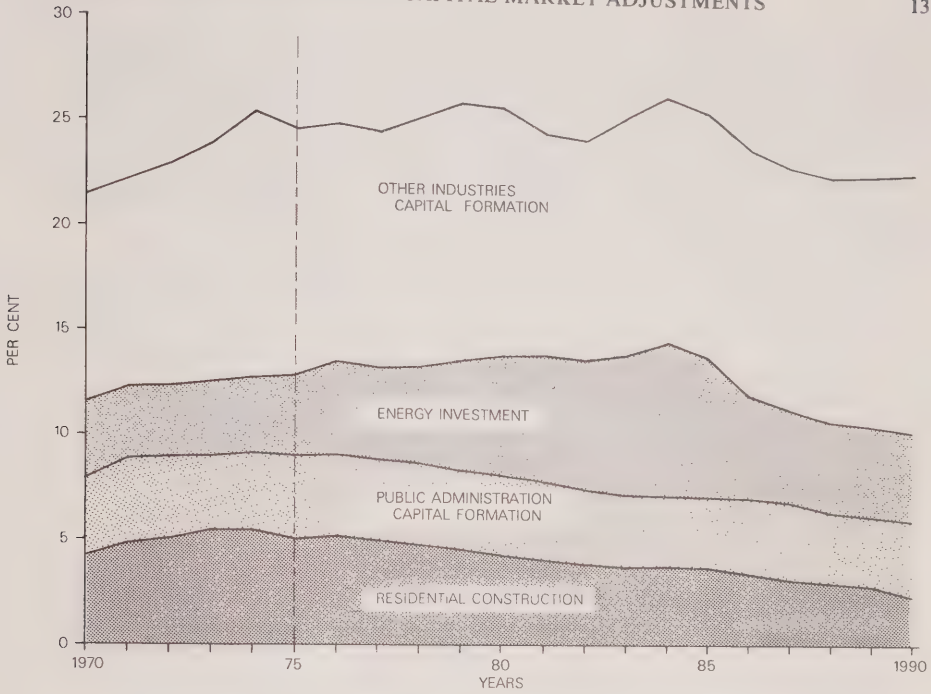


Figure 2-1. Capital formation as % of GNP (1970-1990)

greater proportion. The largest increase in savings is likely to stem from the government sector. The most significant factor causing this will be the increased government revenue generated because the economy will be working at close to capacity. Other important factors will be surpluses generated by the Canada and Quebec pension plans, and reduced unemployment insurance payments as the economy tends towards full employment. Of course the distribution of these savings among the various levels of government is impossible to predict since it will depend on the course of future tax changes and federal provincial agreements.

Foreign savings will decline considerably as a proportion of the total, matching the projected decrease in Canada's current account deficit measured as a percentage of GNP. And indeed the model suggests that by the end of the forecast period Canada will likely be a net lender on foreign markets rather than a net borrower, though foreign capital will remain a significant source of funds for some Canadian projects.

Domestic capital market capacity

The basis of financial markets is the supply of saving. Indeed the size of financial markets—roughly measured by the total amount of domestic borrowing in the economy—has always been closely related to the amount of total saving.

The ratio of domestic borrowings to domestic savings in Canada, has steadily increased since 1972, reflecting a tendency for increased intermediation, and the growing importance of contractual savings. It is difficult to be precise about the exact relationship of borrowings to savings for the future, but in the absence of more concrete information the five year average from 1971 to 1975 of domestic borrowing amounting to 78.1% of domestic saving was chosen for the purpose of this analysis.

The ratio has been applied to the forecast of gross domestic savings generated by the CANDIDE solution, to produce the domestic borrowing figures shown in Table 2-2. This represents an estimate of total domestic borrowing from which the energy industries will have to extract most of their external funding requirements.

Table 2-2

Gross Saving and Domestic Borrowing
Canada 1976-1990

(Millions of $ 1975)

Period	Gross Domestic Saving	Domestic Borrowing
1976-1980	204 725	159 890
1981-1985	271 675	212 180
1986-1990	318 495	248 745
Total	794 895	620 815

The energy sector will not have any special claims on these funds. Capital will flow to the energy industries only if investment opportunities in that sector are competitive with what could be earned in other areas. Available evidence seems to indicate that the energy investment projects discussed in this paper will be economic, and will be able to attract the required capital. If, for one reason or another, this does not occur, it will be up to governments to act or Canada will not reach its goal of energy self-reliance.

Allocation of capital by sector

There are a host of alternative claims on available funds, and to investigate them all one by one would be a never-ending task. Accordingly they were aggregated into six groups, one of which is the energy sector itself. The next few pages contain rough forecasts of the demands of these six sectors; that of the energy sector is estimated in some detail later in this document. This chapter puts these estimates in the aggregative context of the total economy. This reveals how the relative shares of borrowing at the national level will have to adjust over the next 15 years to accommodate forecast levels of energy investment.

The sectors chosen for analysis are households, governments, energy, private non-energy enterprise, and the foreign sector. The household sector has been further disaggregated into consumer borrowing and mortgage borrowing. These sectors when added together give a complete picture of the demand for borrowing on the domestic market. Foreign borrowing has been derived as a residual, but all other sectors have been independently forecast.

The following pages present an analysis of each sector, and an estimate of their future share of total domestic borrowing. The results of this exercise are summarized in Table 2-3.

Table 2-3

Average Shares of Total Domestic Borrowings by Non-financial Sectors

	1971-1975 (%)	1976-1980 (%)		1981-1986 (%)		1986-1990 (%)	
		A	C	A	C	A	C
Housing mortgages	25.3	24.2		17.9		14.1	
Consumer credit and other loans by persons and unincorporated business	20.9	20.7		19.3		19.2	
Governments	24.1	21.9		16.7		12.2	
Energy corporation	7.9	10.8	9.8	18.5	16.1	11.3	15.1
1) Electricity	4.7	6.6	8.0	9.8	10.4	11.1	14.6
Others	3.2	4.2	1.8	8.7	5.7	0.2	0.5
Other enterprises	18.6	21.7		19.5		22.9	
Foreign borrowers*	3.2	0.7	1.7	8.1	10.5	20.3	16.5
Total 100% ($ 1975 million)	$128.5	$159.9		$212.2		$248.7	

*Foreign borrowers' share is a residual item which is affected by higher federal borrowings or redistribution from foreign markets to domestic markets of borrowings from other sectors, namely, provincial and local administration, energy corporations, and other enterprises.

1) The domestic borrowing requirements for electricity are based on the maximum external financing requirements developed in Chapter 4. This has been done to estimate the maximum readjustment which might be required on capital markets.

Residential mortgages

Borrowings by this sector were very heavy over the period 1971-1975. Indeed they absorbed 25.3% of all borrowed funds and were the largest single component of total borrowing. Mortgages are issued to purchase both new and existing houses, so that the importance of borrowing by this sector is related both to new construction, and to the stock of existing houses. In each year some proportion of the latter will be for sale and call for mortgage financing. From 1970-1975 the ratio of mortgage borrowing to the value of residential construction has increased from 55% to 100%, and had an average value over the period of 86.3%. For the past five years inflation in housing costs has been higher than the general rate of inflation. This has reduced the relative size of down payments which could be made and has tended to push up mortgage require-

ments as buyers attempted to finance a larger portion of the price of the house. The era of rapid inflation in housing cost is expected to be coming to a close, and this should cause mortgage borrowing to drop as a percentage of residential construction. On the other hand, residential construction is predicted to fall off, so that the demand for mortgages to purchase existing houses will increase as a percentage of the total. These two forces will probably produce a relationship that will not be far different from the historical one of mortgage borrowing equaling 86.3% of residential construction.

The share of GNP going to residential construction is expected to fall from 5% to less than 3% in 1990, and this produces a decline in residential mortgages as a percentage of total borrowing. This is accentuated by the increase of domestic borrowing as a percentage of GNE from 17.4% to 23% by 1990. The peak occurred in the 1971-1975 period, when it accounted for 25.3% of total borrowing. It is expected to remain high at 24.2% for the remainder of the 1976-1980 period, and then decline to 17.9% from 1981-1985, and reach an average value of 14.1% after 1985.

Consumer credit and other loans to persons and unincorporated businesses

This item exhibits fairly wide fluctuations from one year to the next. The borrowing needs of this sector were forecast on the basis of a five year average relationship between this component of borrowing and consumer expenditures. Over the years 1971-1975 about 5.6% of consumer expenditure was financed through borrowings. Applying this ratio to the model's forecast of these expenditures for the period 1976-1990, suggests that this sector will absorb 20.7% of available funds in the 1976-1980 period, 19.3% from 1981 to 1985, and 19.2% from 1986 to 1990. The slight declining trend is caused by a slowdown in the rate of growth of personal disposable income which is caused by the progressive tax system taking a higher share of personal income as personal income rises, and by the increase in the savings ratio which occurs as the average age of the population increases.

Governments

Borrowings by each separate level of government are difficult to predict because of the sometimes deliberately counter cyclical nature of federal borrowings, and because the distribution of governmental borrowings between the three sectors may well shift with future intergovernmental agreements. To avoid this problem government borrowings are presented as a total, which is liable to be much more stable than any of the individual sub-components. Borrowing by provincial and local administration were taken to equal 94% of their gross fixed capital formation which is the historical average figure. Allowing roughly $2 billion a year for foreign borrowing by this group yields an estimate of domestic borrowing of about 12% of the total which is not far different from the historical figure. As for the federal government, the CANDIDE solution predicted that if existing tax and expenditure programs remain unchanged a federal government surplus will arise. The borrowing

estimates reflect this projected surplus, assuming federal borrowing will average 10% of the total in 1976-1980, 5% in 1981-1985 and zero in 1986-1990. It is worth repeating here that this particular distribution of borrowings may well not materialize. However, if projected surpluses are transferred by some means to other borrowers this would simply lower their borrowing requirements while raising those of the federal government by an equal amount. This would simply reflect a shift in ultimate borrowers and need not affect the analytical conclusions. These are that government borrowings will decline steadily through the period from 24.1% in 1971 to 12.2% in 1986-90.

Energy industries

This group is composed of conventional petroleum exploration and development, oil sands and heavy oils, electricity, and energy mining. Because of the substantial excess capacity which presently exists in petroleum refining and marketing, no significant borrowing requirements for this group is foreseen. The total external requirements of this group, which are derived in Chapters 3 through 6 are summarized in Table 2-4. The maximum estimates of electrical utility borrowings for each of Scenario A and Scenario C were used. There is no compelling reason for choosing this estimate over any other except that it does provide an indicator of what will be the maximum demands of the energy sector on capital markets. Readers may construct their own forecast by using one of the other possible levels of demand for external financing by electric utilities which are outlined in Chapter 5.

Table 2-4

Energy Sector External Financing Requirements[1]
1976-1990

(Millions of $ 1975)

	Scenario A				Scenario C			
	1976-80	1981-85	1986-90	Total	1976-80	1981-85	1986-90	Total
Petroleum	4 290	4 165	(1 340)	7 115	2 510	4 765	625	7 900
Pipelines	5 710	20 420	(2 165)	23 965	2 030	12 290	640	14 960
Electricity	18 600	36 200	48 600	103 400	22 300	38 400	63 300	124 000
Total	28 600	60 785	45 095	134 480	26 840	55 455	64 565	146 860

[1] Energy mining industries are not included in this table because their external financing requirements are relatively insignificant.

Table 2-3 shows how these domestic borrowing requirements alter the energy industries' historical shares of the domestic capital market. From an average of 7.9% from 1971 to 1975 it rises to a peak of 18.5% in Scenario A, and 16.1% in Scenario C in the 1981-1985 period. The principal reason for this increase in share is the rapid growth of electric utilities and consequent growth in

their need for borrowing. From 1971 to 1975, utility borrowings amounted to 60% of the energy total, by 1990 this will have risen to over 95% in both scenarios. External borrowing requirements of the energy sector are closely related to energy prices. Were prices to be higher than assumed, borrowing requirements would be lower because the rise in price would create a redistribution of revenue away from consumer expenditures on other goods to energy investments.

The total external requirements of the energy industries are $12.3 billion higher in Scenario C than in Scenario A. This is due to the heavy reliance on debt capital, caused by the more rapid growth of electrical, oil sands and heavy oil production outweighing the reduction in requirements due to fewer pipelines being built.

The amount of these funds which are expected to be raised in Canada is shown in Table 2-5. These estimates are based on average historical relationships in each industry. The ratios used are 57% for electric utilities, 43% for the petroleum industry, and 79% for pipelines. The percentage of funds which are expected to be raised in Canada by the pipeline industry may appear high in relation to what the domestic financing of the frontier pipelines is expected to be, for example. Our estimate, however, is an average covering expansion of southern pipelines, as well as construction of new frontier pipelines. Applying these ratios to the figures, yields domestic borrowing requirements as is shown in Table 2-5. Total domestic borrowing requirements are some $5.0 billion higher in Scenario C than in Scenario A.

Table 2-5

Energy Sector Domestic External Financing Requirements[1]
1976-1990

(Millions of $ 1975)

	Scenario A				Scenario C			
	1976-80	1981-85	1986-90	Total	1976-80	1981-85	1986-90	Total
Petroleum	1 845	1 790	(575)	3 060	1 080	2 050	270	3 400
Pipelines	4 510	16 135	(1 710)	18 935	1 605	9 710	505	11 820
Electricity	10 600	20 600	27 700	58 900	12 700	21 900	36 100	70 700
Total	16 955	38 525	25 415	80 895	15 385	33 660	36 875	85 920

[1] Energy mining industries are not included in this table because their external financing requirements are relatively insignificant when compared to those of the other energy industries. Estimates are that it should be in the order of approximately 0.2% of total domestic borrowings by non-financial sectors.

Other enterprises

Over the past five years, external financing raised on the domestic market by this group amounted to about one third of its total capital formation. This ratio

has been applied to its projected capital formation to 1990 to obtain an estimate of their required domestic borrowings. This remains relatively steady at close to 20% throughout the period.

Foreign borrowers

Even if Canada is, in general, a net borrower on foreign markets, there are always some foreigners who are interested in raising money in Canada. Since this sector is assumed to be a residual, the analysis does not really forecast what will happen but only the gap on the domestic capital market that could be used either for higher federal borrowings or for redistributing some of the provincial or corporate issues from the foreign markets to the Canadian markets.

Capital market adjustments

Table 2-3 indicated that the major required change in capital markets will be a shift out of mortgages and into energy financing—which will primarily consist of debt issues by electric utilities. Although it is hard to be precise about the difficulties which this adjustment will cause, it seems safe to assume that trust and mortgage loan companies will undergo the major structural change. In 1976, these firms held roughly 75% of their assets in form of mortgages. If they reduce their holdings of mortgages in proportion to the decrease in mortgages as a share of total borrowing, this would require a reduction in holdings of this instrument to between 35% and 40% of their portfolios.

This is a change of considerable magnitude. While the term structure of mortgages and energy bonds would be roughly similar, major differences exist in the other characteristics of these assets. It might be, for example, that some energy financing projects would have different risk characteristics than mortgages, and expertise would have to be developed in establishing appropriate risk premiums. Then, too, the larger size of individual energy projects would likely call for some institutional changes within financial corporations. However, these will occur gradually over a 15 year period so that the magnitude of the required adjustment in any given year should be manageable. The adjustment is likely to be smooth also because this interval could well be one of rapid growth for private financial intermediaries. If the projected decline in federal borrowing results in a proportionate decline in all types of federal bond issues, then issues of Canada Savings Bonds should decline. Should this occur financial intermediaries would likely attract the funds which formerly went to these by offering a similar type of financial vehicle, and this would increase the supply of funds available to them.

What attracted these institutions to mortgage markets in the first place, was the booming demand for housing, and the consequent high rates of interest on mortgages. As the demand for housing declines, so will the demand for mortgages in the economy. At the same time, energy industries will be increasingly anxious to borrow and the decline in mortgage rates will increase the

relative attractiveness of energy bonds to financial institutions, especially if the interest rates on these bonds rise somewhat relative to debt instruments of other sectors.

Thus the readjustment of financial portfolios should occur as a normal development. Banks, trust companies, pension funds and life insurance companies will gradually shift from mortgages to bonds for the same reason that seven years ago they shifted to mortgages—because the prospective rate of return, driven by demand, is higher.

In summary then, it appears likely that the adjustments required should not cause undue disruption in financial markets. Both energy bonds and mortgages are relatively long term instruments, so no major change in the relative sizes of the short and long term ends of the market will be required. The major development is likely to be a change in the type of long term assets held by banks and trust companies. Residential mortgages are rarely for large amounts, and financial institutions can hold many of them and still achieve a considerable degree of diversification, because each one is, in effect, a separate lending project. This is not so with energy financing. Most of the external requirements shown will be generated by a relatively small number of borrowers. Debt may be issued for large indivisible investments on a project financing basis, and financial institutions will be required to concentrate a larger portion of their assets in single projects.

In this context, it is well to mention that the conventional risk diversification by lenders achieved through investing in a large number of smaller loans—relative to total investable funds—will have to be replaced by a wider use of lending syndicates, where these large lumps of capital are shared among lenders. In other words, the process of risk diversification is likely to be shifted from the borrowing to the lending side of the market.

The role of government under these conditions may simply be to ensure that no legislative or regulatory constraints prevent financial institutions from making the adjustments signaled by changing market conditions.

Foreign borrowing

The Canadian energy industries are expected to maintain their historic split between domestic and foreign sourcing of their external funding requirements. This assumption seems to be justified. But since there are many influences on our ability to borrow abroad, it may be useful to discuss some of them, and to analyze the possible impact of not being able to obtain foreign financing to the same degree as has occurred in the past. One hypothesis might be that for some reason the foreign assessment of credit-worthiness of Canadian utilities will decline, so that they can only borrow 30% of their requirements in foreign markets in the 1981-85 period, and only 20% in the 1986-90 period.

This assumption, if applied for the Scenario C case, which would be the most troublesome, would mean that for the 1981-85 period, an extra billion dollars a year would have to be found domestically for borrowings by electric utilities. This would raise borrowings by this sector from 10.4% of the domestic total to 12.7%. For the 1986-1990 period, it would mean that roughly an extra $2 billion a year would have to be found in domestic markets to finance electric utilities. This would increase the percentage of total domestic borrowing incurred by utilities from 14.6% to 15%.

Evidently borrowings by other sectors would have to contract. The impact of this would differ, depending on which sectors are affected. It would be minimal for example, if all of the slack was given up by foreign borrowers, but might be substantial if most of it came from a further reduction in the availability of mortgage credit.

It is impossible to forecast the exact reception which future Canadian attempts to borrow on foreign markets will meet. It will depend, among other things, on the growth of Canada's indebtedness relative to its GNP, and on the growth of Canadian demand for foreign funds relative to the growth of foreign capital markets. It is expected that the demand on foreign capital markets from all countries will be high, but so will the supply be, especially in "petro-dollars". It is well to remember that domestic capital markets cannot be isolated from international developments, and the ease with which domestic markets fill the needs of Canadian energy industries will be affected by the success these industries meet in raising funds in other countries.

Summary and conclusion

The major implication for the Canadian economy of the $180 billion of energy capital expenditures which are expected to occur over the next 15 years have been studied with the aid of the CANDIDE model in a context of moderate but sustained general economic growth, tending towards full employment. The GNP is expected to increase in real terms at an average annual rate of 3.7% throughout the eighties. A situation of virtual full employment is attained in the early eighties, with an unemployment rate of 4.3%. The inflation rate is expected to stabilize at around 5% per annum, with a brief increase of approximately 1% due, in part, to strains created by heavy energy investment in the crucial years 1984-85.

Based on the forecasting exercise conducted with the CANDIDE model, it appears that the energy investment program will merge nicely with the projected moderate general economic growth, and that no serious inflationary pressures will result, even if the economy is operating at close to capacity for some years. Moreover, it seems that the increase in energy-related expenditures will not entail a proportional curtailment of the expansion of other industries, because of the

partially offsetting effect of certain structural changes in our economy. An important example of this is the projected decline in residential and government investments.

It is expected that external financing requirements in the order of $130 to $147 billion will be associated with the $180 billion energy investments which are expected to take place between now and 1990.

Based on average historical relationships in each industry regarding foreign borrowing versus domestic borrowing, projections indicate that total domestic borrowing requirements will be in the order of $78 to $86 billion. The inflow of foreign capital dedicated to the financing of energy projects will, therefore, have to be in the order of $52 to $61 billion, or an average of approximately $3.8 billion a year during the next 15 years. This is about half the total amount of $8 billion borrowed abroad by Canada in 1976.

Domestic borrowings by energy industries as a percentage of total domestic borrowings is expected to rise from a level of 7.6% in 1971-75 to a peak of 18% under Scenario A in the 1981-85 period. Based on the CANDIDE forecast of gross domestic savings and on the average ratio for the past 5 years of domestic borrowings to domestic savings, the total amount of domestic borrowing which will take place over the period 1976-1990 is estimated at approximately $621 billion.

Energy industries will have to compete for the funds with other borrowers. An examination of the projected borrowing needs of the other sectors of the economy indicates that the increased need for funds by the energy sector will be, to some extent, counterbalanced by declining borrowing requirements of the residential mortgage sector and of the federal government. Federal government borrowing is expected to decrease in the future, primarily as a result of the assumption of a full employment economy.

It does not appear that, at the national level, there will be major problems of funds availability, given the ability of financial institutions to gradually readjust their portfolios. In other words, the increased financial needs of the energy sector will call for a restructuring of capital markets, which will likely involve a shift out of mortgages and into energy financing—the latter consisting primarily of debt issues by electric utilities. Furthermore, owing to the very large size of the investments in energy projects, this shift will likely call for a new type of risk distribution based on the diversification of lenders rather than the historical experience of diversification of borrowers.

Sensitivity of conclusions to changes in macroeconomic assumptions

The conclusions of this chapter are, of course, heavily dependent on the macroeconomic projections generated by CANDIDE. What happens to the

conclusion if some of the assumptions are modified? To satisfactorily answer this question a thorough analysis of the sensitivity of the study's results to a range of economic conditions should be done with the CANDIDE model. Nevertheless, a theoretical examination of the broad implications of various economic changes is useful.

The general economic framework set by the CANDIDE model is one of high employment, with the economy operating at close to full capacity most of the time. General economic conditions over the next 15 years may differ from the above assumption in two opposite ways. The economy might be booming during the eighties, with an aggregate demand generally in excess of the production capacity of the economy, or it might instead be operating at a low level of activity, with considerable under-utilized capacity.

If our economy were to be physically overloaded during the period under study with an annual real rate of growth in GNP in excess of 5% and an unemployment rate close to or below 4%, for example—the enormous energy investments forthcoming would add considerably to inflationary pressures and exacerbate shortages of labour, material and capital. In such circumstances, a scarcity of domestic capital and high interest rates would likely lead to an increased reliance of foreign capital markets for the financing of energy projects. Any resulting appreciation of the Canadian dollar would, in turn, induce a reduction of our exports and an increase in our imports. These problems would be further worsened by the increased interest, dividends and debt repayment on the energy project's foreign financing. The relative deterioration of the current account due to the lowering of exports and increase in imports would, however, tend to eventually reduce the inflationary pressures on the economy. The increased reliance on foreign capital could also lead to a further deterioration of Canadian control over the energy sector to the extent that the increased inflow of foreign capital consisted primarily of direct investments. However, this is very unlikely because over 75% of the future external borrowing requirements of the energy sector will consist of debt issue by electric utilities.

In such an environment of a very high general level of economic activity, proper economic management policies would have to be enforced in order to ensure that economic priorities are met. If the energy sector is given top priority, adequate economic policies might have to be put in place to encourage a reduction of the relative growth of the other sectors of the economy in order to permit the full realization of the various energy projects without causing undue disruption of the economy and excessive inflationary pressures. However, given the present general economic trends, it is very unlikely that such a situation will prevail during the period under study.

The other possibility—a lower level of economic activity than that assumed throughout the study—has a higher likelihood of taking place. It could be postulated, for instance, that there will be considerable slack in the economy over

the next 15 years. In such a situation, the projected upsurge in energy investment would be more than welcome as a stimulus to economic growth. In such a situation, domestic financing of energy external capital requirements should be facilitated by a greater availability of capital and a lower cost of borrowing. Also, the risks of manpower and material shortages would practically vanish and energy investments would have little effect on the general level of prices. Greater access to domestic capital markets might cause a reduction in foreign borrowing for the same level of energy investment, exerting downward pressures on the Canadian dollar rate of exchange. Such pressures would have positive effects on our international competitive position at the same time as it would tend to discourage imports. The reduction in dividend, interest and debt repayment following the decrease in foreign borrowing would further improve our current account balance.

On the other hand, such a low general economic performance during the eighties could endanger the realization of federal government surpluses. The budget surpluses at the federal government level depend on the attainment of a full employment economy and on the maintenance of the present tax regime. Should the economy be operating over the next 15 years at a level considerably below capacity, it is unlikely that the projected federal government surpluses would materialize under the existing tax structure. In such a case, the additional room occupied by the federal government on the loan market would more or less be counterbalanced by the room vacated by the non-energy industries because of poor investment prospects, leaving the energy industries in more or less the same situation in terms of capital availability.

Chapter 3. FINANCING PATTERNS IN THE PETROLEUM INDUSTRY

Introduction

The nature of petroleum companies tends to be as diverse as the activities of the industry. It is characterized by a mix of corporate vehicles which range from large fully-integrated companies with billions of dollars of assets to small exploration and land holding entities which measure budgets in thousands of dollars.

This diversity by function and by corporate size dictates that any meaningful analysis of the industry must look beyond aggregate statistics. In order to differentiate among the financing patterns which may emerge for different elements of the industry the sector was disaggregated into three sub-groups:

- senior oils, representing all the major integrated oil companies plus the 30 largest non-integrated, production firms which are foreign controlled;
- large Canadian owned, representing the 30 largest Canadian controlled exploration and production companies; and
- junior oils, representing all other petroleum companies.

Financing of the refining and marketing sectors is not expected to encounter problems and is excluded from projections in this chapter.

Historical financing practices

Figure 3-1 summarizes the sources and uses of funds of the Canadian petroleum producing industry over the period 1960-1974. The bulk of the industry's investment has been financed out of internally generated funds, which accounted for 72.7% of total sources of funds over the interval. Debt was relatively unimportant, with bond issues accounting for only 5.7% of all funds raised and other loans amounting to less than 10%.

This financing pattern is related to the way in which the oil industry in Canada started. A great deal of the early work was carried out by subsidiaries of large oil companies and was financed with funds generated in other petroleum basins located outside of Canada. Smaller entrants were initially financed through the issue of shares, and subsequent discoveries were developed either by selling them or by developing them jointly with larger, financially more secure corporations. This was necessary because it was difficult to obtain debt financing for development expenses if the corporation's sole major asset was a petroleum discovery. This lack of assets, plus the long lead times between the initial

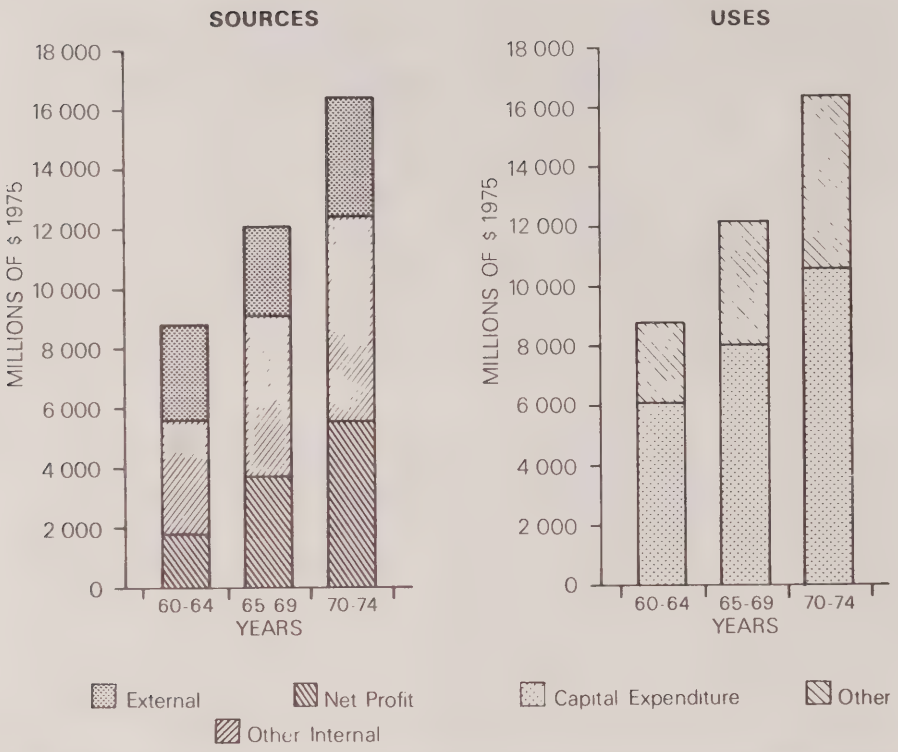


Figure 3-1. Source and use of funds—petroleum producing industry (1960-1974)

investment and payback, tended to create a heavy interest burden for debt. In addition, the risk exposure was not within the bounds of the lending communities loan criteria. As a result, reserves and production capacity were mainly accumulated by the larger firms, in the early stages of the petroleum industry's development. Financial constraints were seldom an impediment to growth.

Framework for future investment

The pattern of financing in the oil and gas industry is now changing significantly. The major energy investment requirements in Canada will necessitate an unpredecented demand for funds. Heavy oil projects and frontier ventures will challenge the financial resources of even the most powerful Canadian firms, and for some projects the leverage provided by debt financing may be necessary to enhance the commercial attractiveness of the project. Future development, and the pace thereof, may depend to a much greater extent on the linkage between the oil and gas industry and capital markets, and on the fiscal systems within which investments will be made.

Over the past three years, there have been significant changes in the fiscal regime under which the petroleum industry operates. Following the sharp upward rise in world oil prices initiated by the major exporting nations, both federal and provincial governments moved independently to absorb some of the windfall gains being reaped by the petroleum companies from export sales at international price levels and from the higher prices authorized by governments for domestic sales. Initial conflicts between the two levels of government over relative shares of tax and other forms of revenue gave way to co-operation as both the federal government and governments in the producing provinces took steps to modify their fiscal regimes in order to provide added incentives to undertake the greatly increased cost of finding and developing new oil and gas reserves. In addition, they also took steps, directly or indirectly, to recycle energy-generated funds back into energy resource investment.

Investment criteria

The future investment behaviour of the petroleum companies will be conditioned by several factors, including:

- the geological opportunities and the existing technology for development in Canada;
- the economic and financial characteristics of the investment opportunities; and
- the funds which the industry will have available for investment.

Geological opportunities and technological development

Substantial geological prospects remain in Canada, but when the economic and financial characteristics of the investment opportunities are taken into account, the set of geologically feasible developments is narrowed down considerably to the economically viable ones. Opportunities for investment in conventional production areas in western Canada still exist, but over the next 15 years they will decline in relative importance. These pose no special economic or financing problems under the existing fiscal systems, assuming the continued movement of price toward international levels. There are, however, promising opportunities for large scale increases in petroleum supplies through oil sands, heavy oil, and frontier exploration and development. Technological changes, price developments, fiscal incentives, and new financing techniques may in some cases be necessary before they become economically attractive to the private sector.

It is difficult at this time of rapid change to be categorical about the exact pattern of investment which will emerge. The scenarios in this study indicate investments which will occur, given certain broad assumptions. However, these are not meant to be exclusive. It is quite possible that other petroleum investments will occur in conjunction with them. Obvious examples of these are in situ

recovery of oil sands, and coal liquefaction and gasification, any of which may be rendered economic by technological change. Indeed, such processes may make significant contributions to our energy supplies in the medium term future.

Economic and financial conditions and alternative investment opportunities

The extent to which the industry will invest in conventional and frontier exploration and development and non-conventional oil production will depend on the profitability of these ventures. The risk and rate of return characteristics of these investments will have to be competitive with those available in petroleum investments outside Canada and even with non-petroleum alternatives in Canada. The fiscal treatment of the Canadian industry must recognize that other uses for available capital exist, and ensure that rates of return from petroleum investments in this country remain attractive.

Conventional exploration and development of natural gas in western Canada has become exceptionally attractive due to the combination of higher prices and provincial incentives. In fact, short term demand in Alberta is incapable of absorbing new production capacity at present. Investments in this area are likely to remain attractive, but energy self-reliance for Canada will require major petroleum investments in the more difficult areas of the frontier and for development of non-conventional oil.

Frontier investments offer the prospect of a good rate of return only if sufficient reserves are developed to justify transportation systems. While results to date have been disappointing, much geological information remains to be gathered, and it is likely that investment in this area will continue for some time in the hope that it will be justified by a major profitable find. Impetus is given to this investment by federal tax incentives, which reduce the private cost of exploration, but only major discoveries will ensure that large expenditures will continue to be made.

A major role may exist for governments in the area of non-conventional oil. There are in western Canada large proved reserves of technologically recoverable heavy oil. Governments and industry are now considering fiscal regimes which would ensure the profitability of large scale heavy oil projects. The creation of an appropriate fiscal climate could add a significant new source of oil to Canadian production.

Oil sands reserves represent one the world's largest proved oil resources. However, the mining of oil sands is so expensive that even with a Syncrude type of fiscal package—which includes world prices and accelerated tax write-offs—the economics may not be commercially attractive, although leveraging through high ratio borrowings might improve the economics of such projects.

Availability of investment funds

Table 3-1 indicates that although internal fund generation could provide the bulk of required financing, major borrowings may be necessary to enhance the economics of oil sand development. Borrowing in the latter part of the period will be higher in Scenario C than in Scenario A because of the expected heavy debt requirements of oil sands and heavy oil projects and because of the lower generation of cash flow than in Scenario C. Capital expenditures are expected to absorb approximately 50% of the total available funds on average over the period. After financial costs such as dividends and interest payments have been met, it is expected that the balance—approximately 25% of the funds—will finance a diversification of investments into new areas. While diversification of expenditures is a normal strategy for any dynamic industry, there is at present some concern about the level of reinvestment by the petroleum industry. It is for this reason that a voluntary system of monitoring capital expenditure patterns of the industry is already in place, one that is to be reinforced by reporting requirements established by legislation.

Table 3-1

Petroleum Producing Industry Sources and Uses of Funds (1976-1990)

(Millions of $ 1975)

	His-torical	Scenario A			Scenario C		
	1960-74	1976-80	1981-85	1986-90	1976-80	1981-85	1986-90
Sources							
Internal	27 060	18 200	26 590	31 140	17 440	26 100	25 330
External	10 170	4 290	4 165	(1 340)	2 510	4 765	625
Total	37 230	22 490	30 755	29 800	19 950	30 865	25 955
Uses							
Cap. Exp.	24 670	13 575	17 725	14 545	10 490	15 480	12 010
Other	12 560	8 915	13 030	15 255	9 460	15 385	13 945
Total	37 230	22 490	30 755	29 800	19 950	30 865	25 955

Characteristics of financing by petroleum sub-groups

Although no shortage of investment funds is expected in aggregate, this is not necessarily true of all segments of the industry. The number of single, low-cost projects in western Canada is rapidly diminishing. Increasingly, new developments will depend on firms banding together to pursue investments quite beyond the scope of any of the individual partners. There are indications that some sectors of the industry —if not the entire petroleum sector—are increasingly aware of financial constraints. Thus, a new emphasis on financial problems may be expected. An examination of industry accounts by sub-groups will help identify these constraints and indicate how financial innovations are likely to evolve.

The share of net profits and of capital expenditures accounted for by each of the three sub-groups identified—senior oils, Canadian owned and junior oils—are provided in Table 3-2. It shows the present structure of the industry and provides a benchmark against which possible changes in this structure may be assessed. It is interesting to note that the senior oil group accounts for between 88-95% of net profits but only 79-89% of capital expenditures over the period. The opposite situation prevails for the small firms, which have consistently generated a higher share of capital expenditures than of net profits. As will be evident in the financial analysis to come, small firms have done this by relying much more heavily on external financing than the large firms. Whether or not this financing pattern will continue to be possible in the future is an important question, to which this study attempts to find an answer.

Table 3-2

Petroleum Producing Industry Structure

	Net profit Per cent of total			Capital expenditures Per cent of total		
	1960-64	1965-69	1970-74	1960-64	1965-69	1970-74
Senior oils	87.7	88.8	95.3	89.2	85.6	78.8
Large Canadian owned	6.1	5.4	5.0	2.8	5.5	5.9
Junior oils	6.2	5.8	(0.3)	8.0	8.9	15.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Senior oils

Firms in this category have well-established production capacity. As a result, internally generated funds constituted 77% of total sources for the 1960-74 period. Internal funds increased from 62% of total sources in the first part of the historical period to 86% by the early seventies. This relatively rapid growth has been maintained as the profits generated by earlier investments continue to benefit from the policy of moving petroleum prices towards international levels. Consequently, there has been a reduction in this group's dependence on debt and equity financing. The percentage of funding from these sources declined from 33% to 8% over the same period. Figure 3-2 illustrates the summary statement of sources and uses of funds from 1960 to 1974.

The projection for the future is that this group is likely to experience a continuing decrease in its reliance on external financing. However, it is also expected that the behaviour of this group will be quite different in each of the cases examined. This occurs because frontier expenditures will be much lower in the Scenario C than in the Scenario A case. It is the large firms which incur the bulk of frontier capital expenditures, so it is these firms whose capital expenditures will decrease the most in Scenario C. Some of this slack is taken up by increased oil sands and heavy oil expenditures, but increased diversification is also quite likely. Table 3-3 summarizes projected financial conditions of the senior oil group for each of the two cases examined.

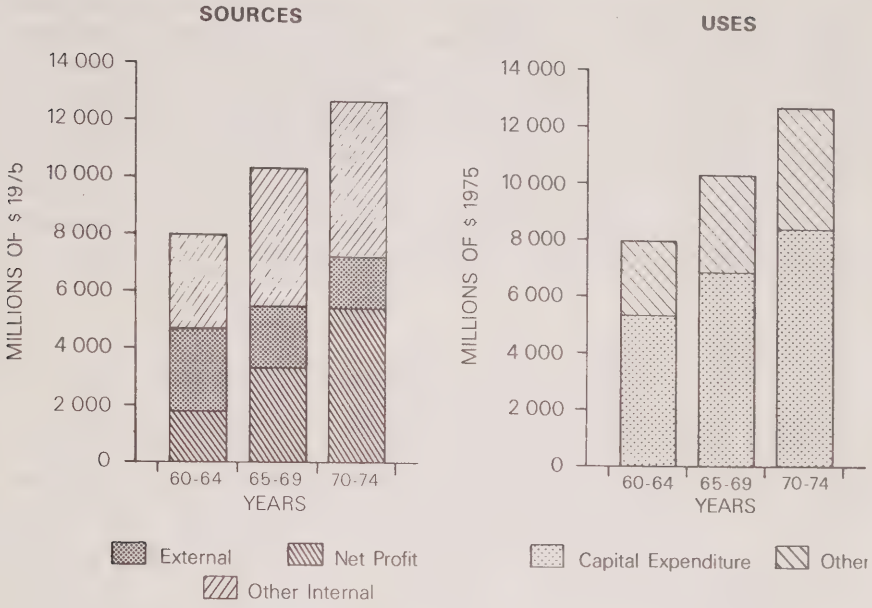


Figure 3-2. Sources and uses of funds—senior oil (1960-1974)

Table 3-3

Sources and Uses of Funds – Senior oils (1976-1990)

(Millions of $ 1975)

	Scenario A			Scenario C		
	1976-80	1981-85	1986-90	1976-80	1981-85	1986-90
Sources						
Internal	15 285	21 540	24 600	14 605	21 140	18 935
External	1 475	1 070	(2 665)	(610)	260	(1 995)
Total	16 760	22 610	21 935	13 995	21 400	16 940
Uses						
Capital Expenditure	9 270	12 055	9 885	5 975	8 820	5 980
Other	7 490	10 555	12 050	8 020	12 580	10 960
Total	16 760	22 610	21 935	13 995	21 400	16 940

Capital expenditures as a proportion of total uses of funds averaged around 66% over the period 1960-74. For the future, a declining trend is expected in both scenarios. In Scenario A, capital expenditures fall from 55% of total uses in the 1976-1980 period to an average of 45% in the 1986-1990 period. In Scenario C, the declining trend is even more marked. Capital expenditures are 42% of total uses over 1976-80, fall to 41% over 1981-1985, and to 35% in 1986-90. The difference in the scenarios is more dramatic when it is noted that fund generation is substantially lower in Scenario C, with a resulting decrease in the base against which the above percentages are measured.

Canadian owned large exploration and production companies

This group is composed of crown corporations, such as Petro-Canada, as well as private corporations. Firms in this group are for the most part considerably smaller than those previously discussed, but they have a steady and reliable cash flow and their borrowing capacity is such that most of them could initiate or at least participate in significant frontier or oil sands projects. This group relies on internal funds to a much lesser extent than the other groups discussed. Figure 3-3 provides a graphical picture of the sub-group's sources and uses of funds. Internal funds accounted for 60% of total sources from 1960-1974; external financing—particularly by means of equity issues—was very important, accounting for the remaining 40% of total sources. This is more than twice as much as was the case for the large non-resident owned companies. In the past, capital expenditures have accounted for 57% of uses of funds, although the trend is upwards. This is considerably lower than the 67% achieved by the large non-resident owned firms.

Table 3-4 shows that the size of this group will increase significantly in the future due to the good investment prospects of these firms, as well as action taken to increase Canadian ownership in the industry. This action includes regulations governing Canadian ownership, as well as the involvement of major crown corporations in the petroleum industry. By 1990, capital expenditures by this group will account for 20% of the industry total in Scenario A, and 31% in Scenario C, as compared with 5.9% of the total in the 1970-74 period. This rapid growth will be financed by a heavy infusion of external funds, particularly through crown corporations. In the Scenario C case, major oil sands involvement could raise external fund requirements to 45% of total sources, while in Scenario A they could rise to 33.7% of total sources. These funds may not all be borrowed—some could be assigned directly to crown corporations by the appropriate levels of government. The growth in internal fund generation will be much slower, reflecting the lag between capital expenditures and the receipt of income generated by them. In the 1986-90 period this sector will account for 13% of total internal fund generation in Scenario A, and 15% in Scenario C. However, these percentages should rise quickly in the subsequent decade as the heavy investments of the 1980s start to generate profits.

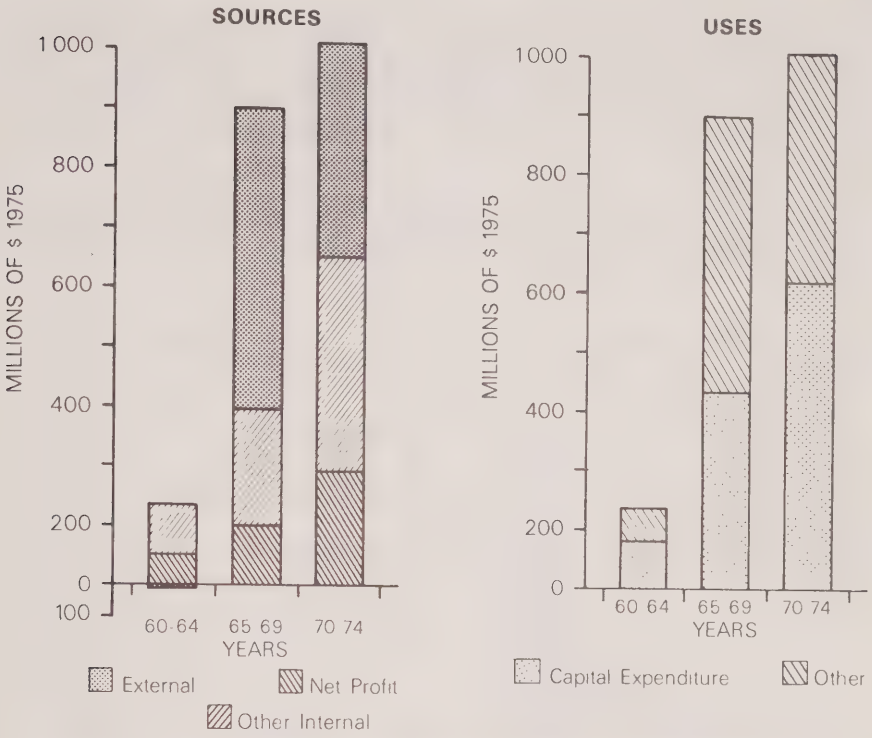


Figure 3-3. Source and use of funds—large Canadian owned exploration and production companies (1960-1974)

Table 3-4

Sources and Uses of Funds – Canadian Owned Large Exploration and Production Companies

(Millions of $ 1975)

	Scenario A			Scenario C		
	1976-80	1981-85	1986-90	1976-80	1981-85	1986-90
Sources						
Internal	1 640	3 190	4 050	1 610	3 130	3 865
External	1 740	1 920	845	2 005	3 205	1 885
Total	3 380	5 110	4 895	3 615	6 335	5 750
Uses						
Capital Expend.	2 575	3 545	2 910	2 730	4 335	3 750
Other	805	1 565	1 985	885	2 000	2 000
Total	3 380	5 110	4 895	3 615	6 335	5 750

Junior oils

This category is composed of a large number of small companies, many of whom have little production and consequently little sustained income. The majority of these firms are basically explorers, often selling a discovery as soon as it is found.

Figure 3-4 indicates that their reliance on external funds, mainly equity, is generally higher than is the case for the other groups.

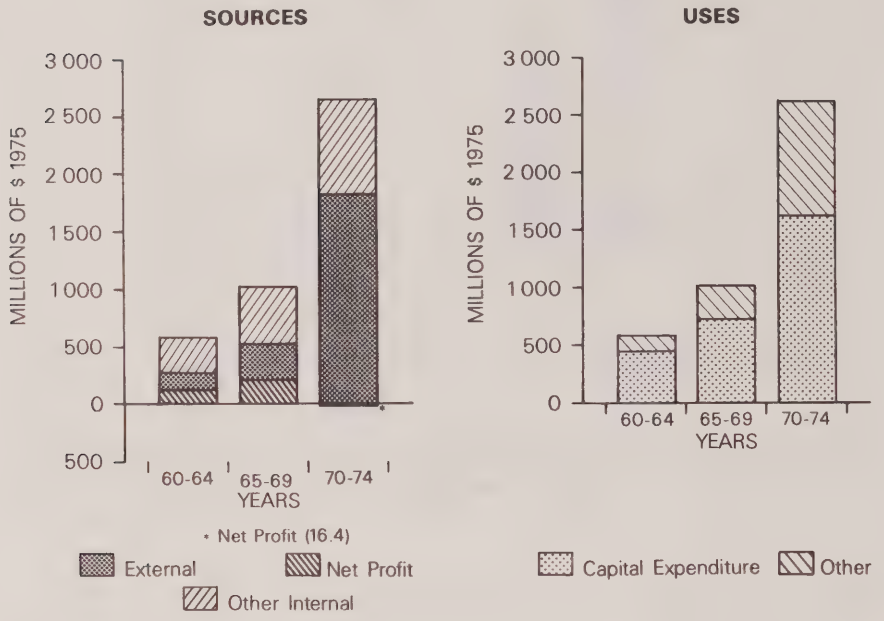


Figure 3-4. Sources and uses of funds—junior petroleum companies (1960-1974)

Some caution is necessary in analyzing the trends indicated by the financial summaries, since firms which are successful explorers and which diversify into production as well as exploration will tend to drift into the large exploration and production group. Home Oil Ltd. is one example of a company which started small but now ranks with the larger firms. Other companies may be unsuccessful in their exploration, only to be replaced by others eager to get in on the oil business, even if only on a small scale. Another historical characteristic of this group is the tendency for the more promising junior firms to be "bought-out" by the large senior firms. The list of such takeovers is a lengthy one. This form of "exit" from the group tends to worsen the aggregate financial picture of this category, since it is usually the more successful firms which are takeover targets.

With the implementation of the Foreign Investment Review Act, some lessening in such exits should occur in future years. However, the effect of this continuous entry and exit is to render aggregate statistics for this sector somewhat misleading.

For example, the small firms when viewed separately are the only group to show a loss over the 1970-74 period. This does not mean that firms which operated profitably through the 1960's started to lose in the seventies. The explanation is that many new firms with no production entered the arena during this period of buoyant expectations and their initial expenditures were greater than the profits sustained by the more established firms. This hypothesis tends to be supported by the large increase in capital expenditures in 1970-74 over 1965-69. Such an increase would be extremely unlikely if the firms involved were consistently losing money.

The small firms will continue to focus their operations in conventional western Canadian areas. Their participation in large oil sands and heavy oil projects will be limited by the size of the individual contribution which these firms can make. Such a firm's contribution may be so small that it would not be large enough to justify the bother of adding another partner to the consortium. A further limitation will be the ability of these firms to raise financing on the required scale.

Table 3-5 shows the sources and uses of funds these firms might have in Scenarios A and C. This table is probably more tenuous than the others that have been prepared because so much will depend on hard to predict issues such as the degree of success these firms will experience in raising external funds. The table should be taken simply as an indicator that the growth of these firms could be limited by financing.

Table 3-5

Sources and Uses of Funds: Junior Petroleum Companies (1976-1990)

(Millions of $ 1975)

	Scenario A			Scenario C		
	1976-80	1981-85	1986-90	1976-80	1981-85	1986-90
Sources						
Internal	1 275	1 860	2 490	1 225	1 830	2 530
External	1 075	1 175	480	1 115	1 300	735
Total	2 350	3 035	2 970	2 340	3 130	3 265
Uses						
Capital expenditure	1 730	2 125	1 750	1 785	2 325	2 280
Other	620	910	1 220	555	805	985
Total	2 350	3 035	2 970	2 340	3 130	3 265

Summary of financing patterns

The disaggregated sources and uses of funds projections address the question: how will the expenditures the scenarios require be financed, and how will the opportunities for growth they represent be divided among the various sectors of the industry?

The most obvious conclusion from this analysis is that at the aggregate level, present fiscal terms and pricing policies provide the cash flow necessary to undertake the investment projects envisaged. In Scenario A, it is likely that this cash flow will be utilized to undertake the investments stipulated, although certain groups of the industry may find themselves short of funds. However, the industry has developed a number of techniques for transferring funds from firms in a surplus position to those which require additional funding. Farm-ins and other such instruments would seem well suited for directing the surplus cash of the industry to those segments which are most likely to need it. The Scenario C case is somewhat different.

In Scenario C, industry cash flow, at $68.8 billion, will be more than enough to cover the projected investments of $38 billion. The difficulty related to the distribution of this cash flow which was described in Scenario A will remain. However, a more fundamental problem exists in this case. It relates to the incentive to invest. The industry may find a moderate investment on a commercial basis in oil sands and heavy oils to be an attractive prospect. However, the investments in this area which are contained in Scenario C are not modest, but rather dramatic. It is possible that under present conditions the required investment may not be forthcoming. The total oil sands and heavy oil investment bill in Scenario C is in the vicinity of $15 billion. Without specific government initiatives to increase the attractiveness of the investment, and in the absence of major technological improvements in the recovery process, much of the investment might not occur.

These initiatives could take many forms. In the Syncrude case, government equity participation, government loans, special fiscal terms and price guarantees, were the methods chosen. For future projects, different methods, or a different mix of methods might be appropriate. It is basic to the Scenario C case that measures appropriate to the circumstances at the time be designed to increase the attractiveness of synthetic production. To do otherwise would expose Canada to a dangerously high risk of disruption in energy supplies.

The ownership and control of the industry is of concern to the government. Large multinationals have formed the core and provided the impetus for the petroleum industry in Canada and they are expected to continue to do so. However, it may be necessary and desirable in the future to provide financing alternatives so that when intra-industry transactions take place, the weaker members will not find it necessary to surrender control and ownership of their discoveries and reserves, particularly to foreign interests.

Improving the flow of funds within the industry could have major real benefits. The small companies have a history of innovation and success in exploration. The intermediation vehicles of the type suggested to direct funds from companies with surpluses to those requiring additional financing should enable these firms to employ their expertise in difficult frontier areas. The result could well be a more successful, and perhaps even less costly exploration program.

Chapter 4. PIPELINE FINANCING

This chapter does not go into detail on the specific financing arrangements of proposed pipelines. This was a deliberate choice because at the time of writing there was considerable uncertainty over which of the different pipelines would be authorized, since the ongoing review process had not been completed. As for a potential Arctic Islands pipeline, no detailed financing plan has yet been prepared. While detailed financial assessments of whichever pipelines are built, will of course be required, the time when these can be usefully performed has not yet arrived. Accordingly, this paper briefly addresses generic issues which would apply to any major frontier pipeline.

The Canadian pipeline industry is composed of a few major companies involved in the transportation of oil and gas. This industry has been regarded as providing a utility type service, and therefore it is heavily regulated.

In common with other utilities, pipelines have relied heavily on bond financing in the past. From 1960 to 1974 external financing, primarily in the form of bond issues, accounted for just over half of all sources of funds.

It is apparent that major changes are facing this industry. Capital expenditures from 1960 to 1974 amounted to $8 billion, which is approximately the cost of one frontier pipeline. As many as three such pipelines may be required in the next 15 years, which would call for a very rapid rate of expansion in the industry. Of course, large expenditures on individual pipelines and sudden spurts of growth are not new to this industry. The Trans Canada PipeLine system that was started in 1956 cost a billion dollars. Evaluated in present dollars, that amount would probably be $3 to $5 billion. The Trans Canada PipeLine system was financed nevertheless without major difficulty, although the Canadian economy at that time was much smaller than it is now. What is unique about the future is that more than one major pipeline may have to be built in a relatively short interval through some of the most difficult terrain in the world.

For the next 15 years there will be two major classes of pipeline expenditures required.

The first is capital expenditures for repair, maintenance and expansion of existing pipelines, which will amount to about $8 billion by 1990. The remaining expenditures will be for frontier pipelines and will amount to $20 billion in Scenario A, and $8 billion in Scenario C. These expenditures are in a totally different category in terms of risk and cost than conventional pipelines.

Capital expenditures on southern pipeline projects are expected to be financed by traditional methods. No major technological, ecological or social problems are expected and these pipelines will service areas with well-defined reserves and costs. The phasing out of oil exports, however, may create some problems for certain existing pipelines as the transportation network changes.

Frontier pipelines will undoubtedly be more difficult to finance than those south of sixty degrees because of the unprecedented economic risks they face. Firstly there is the risk that they will have to be built with proved reserves only marginally greater than threshold levels. Secondly, there are technological problems—for example, the crossing of ice-laden deep water channels between Arctic Islands. Thirdly, there is the risk of cost overruns due to inflation, project design deficiencies, and the development of unforeseen problems. Fourthly, because frontier gas is one of the more expensive sources of energy, there is the risk that there would not always be a market for this gas at the price required to make its production economic.

These considerations have led some proponents of frontier pipelines to suggest an all-events tariff, which would virtually transfer all such risks to distributors—and ultimately to consumers. They have further indicated that capital may be attracted to this venture only if the federal government provides a backstop in the event of cost overruns so as to ensure completion of the project.

In the past, substantial loans at favourable terms could be obtained for pipelines from gas users in the United States on condition that some of the gas transported be available for their use. To the extent that future gas supplies are only available for Canadian consumption, U.S. capital may be available only from financial markets, which may be more sensitive to risk factors.

Project financing would undoubtedly be used to raise the debt. Principal and interest payments would be met out of revenues from the project. Revenues would be guaranteed by contracts which force pipeline users to pay at least a minimum tariff on contract delivery rates even if they are unable to produce contracted rates of gas. It is likely that project financing of this magnitude would have to be handled by a consortium of Canadian lending institutions, which would syndicate the loan and parcel it out to other banks on international markets. This reliance on international financing would be essential to the diversification of the portfolio of Canadian financial institutions.

Table 4-1 shows that if past financial practices are followed, about 25% of the external funds will be equity, and about 75% debt of one kind or another, most of it long term. This will require raising long term debt in the order of $15.3 billion during the five year interval of 1981-1985 if three frontier pipelines are built, and as much as $9.2 billion could be required if only one line was constructed. When it is remembered that tar sands, heavy oils and electric utilities may also create a large requirement for long term debt financing over the same period, the potential for strains on the long term debt market becomes obvious. Such strains would be reduced if, for example, large oil companies were willing to transfer funds to pipeline companies. This is a possibility, given the interest that such companies have in ensuring that frontier pipelines are built, although they might do so reluctantly and only as a last resort in the case of gas pipelines.

Table 4-1

Canadian Pipeline Industry Financing Patterns

(Millions of $ 1975)

	Historical	Scenario A			Scenario C		
	1960-74	1976-80	1981-85	1986-90	1976-80	1981-85	1986-90
Sources							
Internal	6 345	1 965	4 725	11 670	1 965	2 285	5 620
External	6 370	5 715	20 420	(2 160)	2 030	12 290	640
Total sources	12 715	7 680	25 145	9 510	3 995	14 575	6 260
Uses							
Cap. exp.	7 725	5 710	19 205	3 045	2 455	11 465	2 810
Other	4 990	1 970	5 940	6 465	1 540	3 110	3 450
Total uses	12 715	7 680	25 145	9 510	3 995	14 575	6 260

Chapter 5. ELECTRIC UTILITY FINANCING

Introduction

The Canadian electrical utility industry is composed of a few major provincially owned crown corporations and a larger number of small private utilities. Ontario Hydro and Hydro-Quebec alone represent 45% of all electrical generating capacity in Canada. Partially because of geography and other economic factors, the composition of generation modes varies considerably from province to province, ranging from highly preponderant hydro generation to highly preponderant thermal generation. This difference in generation types contributes to the rather large variance in the average cost of electricity across Canada.

Historically the utilities benefited from rapid growth in demand, which facilitated the exploitation of scale economies and permitted real electricity costs to fall. Financing problems were minor because the availability of provincial guarantees made utility bond issues virtually risk free investments. Traditionally, internally generated funds accounted for about 30% of all sources of funds. Bond issues were by far the most important source of funds since the prevalence of public ownership made equity issues of negligible importance.

The situation has changed recently as the utilities are now entering an era of increasing unit cost. Economies of scale are exhausted at generating unit sizes which are now common. Good hydro sites close to load centres are becoming increasingly rare and the ones still available are complex and costly to develop. Oil price increases have raised the cost of operating thermal stations and have induced utilities to switch existing expansions and those planned for the future from oil fired to nuclear stations, with a resulting increase in capital requirements.

The switch to higher cost and more capital intensive generation projects may reduce the attractiveness of provincial guarantees of utility debt, particularly in the smaller provinces. Moreover, the amount of funding required causes some reluctance on the part of provinces to guarantee debt in the amount required for utilities to meet their expansion plans.

The new importance of risk

The major financing difficulties which are likely to arise are related to increased risk, and to the fact that capital requirements for expansion are likely to be very large relative to existing cash flows. There are three separate risks to be considered. The first is that utility demand forecasts are too high, in which case

projects started now on the basis of these forecasts may not be able to generate sufficient funds to service the debt required to build them. The second risk is that the borrowing will strain the credit rating of the provinces and in some cases may, in fact, not be possible. The third risk is that the initial estimates of capital and operating costs may be exceeded.

The risk that forecast demand growth will not occur is a new phenomenon. Historically, utility forecasts of demand growth have always been close to the mark. Now the price of all forms of energy has increased dramatically, augmenting the percentage of consumer budgets which are spent on energy. As the importance of energy costs increases, consumers should become more cost conscious and this might induce them to cut back on all forms of energy use—including electricity. Due to the long lead times associated with electrical capacity expansion, there is the risk that the capacity being added will exceed demand. Of course, if power surplus to domestic requirements can be exported at a profit, this problem will be overcome. However, power exports are subject to regulatory approval, and would in any case be difficult to arrange should U.S. utilities find themselves in a similar position of overcapacity.

Allied to the risk of overcapacity is a further problem: What is perceived to be the cheapest and most efficient way of meeting demand growth—installation or a nuclear or remote hydro plant—is also the most capital intensive and most uncertain in terms of cost estimates. Such developments might have the same probability of cost overruns as an individual thermal project, but they would also have a higher probability of overruns than several thermal projects which might produce roughly the same amount of power. In fact, as the smaller projects are put in place the experience gained may serve to reduce costs and the probability of overruns on later plants.

When the probability of demand growth being less than anticipated is combined with the probability of cost overruns, the large, capital intensive project may begin to look too risky for many investors. If the project turns out to be vastly more profitable than anticipated, it will not affect at all the position of the debt holder. However, the debt holder must concern himself with the probability that the project will not be as profitable as anticipated and will inhibit the utility's ability to meet debt service payments. Consequently, the section of the market to which utilities have traditionally appealed for funds may become less interested in the type of investment which will increasingly be presented, at least in the case of the smaller provinces. This is not to say that such investments are necessarily unprofitable or unwise; quite the contrary. However, they possess risk and rate of return characteristics which could make them interesting only to a different class of investor. This type of investor is at present effectively barred from participation by provincial ownership.

Role of the federal government

The federal government is concerned with utility financing problems because by virtue of their size and importance as an industrial input the expansion plans of electric utilities affect the entire economy. The federal government would also like to ensure that energy costs display the minimum possible variance across the country. Moreover, the rate at which electrical energy relieves pressure on scarce hydrocarbons is of fundamental importance in terms of the government's national energy strategy.

Past federal financial assistance has taken the form of loans or grants on individual projects. However, the burden imposed by the increasing number of projects which may require assistance, and the changing nature of the utilities financial problems, indicate that it may be appropriate to consider whether a change in the type of financial aid offered may improve efficiency.

One possible approach could be to make available to utilities—on commercial terms—a new source of funding which would involve acceptance of additional risks in the expectation that sometimes they would pay off with unusually large benefits. Other options are of course possible, but for the sake of concreteness this one will be discussed in some detail. Because it would be necessary to consider at length the relative merits of all the possible options before adopting one of them, the discussion which follows should be taken simply as representative, rather than as a definite proposed course of action.

Take the example of a new nuclear facility being constructed by a relatively small utility. The nuclear plant could be incorporated as a separate unit jointly owned by the federal government and the participating provinces. In exchange, the federal government could contribute some percentage of the cost of the project in form of equity. Another portion of the cost could be put up in the form of equity by the provinces. The project could be further guaranteed by a sales contract under which the provincial utility agreed to buy power from the nuclear unit at a rate which would cover at least its cost of operation. With these kinds of safeguards, the downside risk would be largely removed. As a result, it should not be difficult to finance the remainder of the cost in debt markets.

This type of intervention may have numerous benefits. First, it aims directly at what appears to be the major problem of utility financing –excessive risks, since some of the risks would be transferred from the utility to the federal government. Second, to the extent that equity participation would require a smaller federal contribution than existing debt oriented schemes, it would reduce on a project by project basis the drain on the federal treasury and thus enable more projects to be financed. This more market oriented approach might serve to limit the federal commitment, while at the same time broadening the scope of projects which could be assisted.

Scenarios and financial projections

Scenarios

Chapter 1 summarized the electricity supply scenarios on which the financial analysis is based. Further information, including capital requirements, the amount of energy generated, and a breakdown of capacity by type is given in Table 5-1. In Scenario A, capacity growth is assumed to occur at 5% per annum, while in Scenario C the growth rate is assumed to be 7% per annum.

Table 5-1

Basic Assumptions of Electricity Financing Scenarios

		Scenario A			Scenario C		
Year	1975	1980	1985	1990	1980	1985	1990
Energy generated (Billions of kW/hr.)	280	355	435	538	369	471	586
Generating capacity							
(MW) hydro	36 800	42 500	55 500	66 200	46 700	61 900	72 500
Thermal	20 080	23 700	29 500	36 800	25 400	31 400	49 800
Nuclear	2 660	6 200	12 800	22 200	6 900	17 800	29 500
Total	59 540	72 400	97 800	125 200	79 000	111 100	151 800
Capital expenditures (millions of $ 1975)	3 500*	5 400	7 000	8 000	6 160	7 370	12 220

	Scenario A	Scenario C
Total capital expenditures 1976-1990 (millions of $ 1975)	91 200	110 000

* Figure shown is for 1976

The difference between these two growth rates—26.6 thousand megawatts by 1990—reflects the uncertainty concerning demand growth which now confronts the utilities. The 5% growth case assumes that consumers respond to higher energy prices by cutting back on all forms of energy, including electricity. The 7% growth case assumes that a drive for interfuel substitution will keep the growth in demand for electricity at historical levels, despite the increase in power costs.

Financial projections

Financial projections have been constructed for each of the Scenario A and C cases. The projections were made by relating fixed and variable cost charges to each component of generating capacity, and by calculating the

revenues which utilities would derive at assumed sets of prices. This technique avoids the difficult task of predicting what time path future electricity prices are likely to take. The appropriate pricing of electricity is at present a fiercely debated issue. Both marginal and average cost pricing have their proponents. Undoubtedly, the pricing scheme which finally emerges, and the rate at which prices increase will be the outcome of decisions by provincial regulatory bodies. The prices derived in this study do not prejudge the outcome of these decisions. These prices are defined as average revenue per unit of power sold and for this reason they may differ from actual prices seen in specific markets at specific times, which will be effectively determined by the specific pricing philosophy chosen by each utility. The average prices derived in this study could mask considerable diversity in the price structure within each utility, as well as considerable diversity in the average prices charged by different Canadian utilities.

The method adopted does establish the relationship between the average price at which power is sold, and the need for external financing. Moreover, those ranges of average price which would seem to be unreasonable from a financial standpoint, can be eliminated.

Utilities in Canada have on the average over the past 15 years, operated with about 70% external financing. Given the financial pressures utilities are expected to encounter, it would seem reasonable to assume that this ratio will not drop, so a 70% reliance on external funds may be taken as the minimum demand by utilities on capital markets. As an upper bound on capital requirements the case where external sources account for 90% of all funds might be taken. Figures 5-1 and 5-2 illustrate the amount of borrowing and the range of average prices which are consistent with these financial ratios for each of the cases examined. Maintenance of a 70% external financing requirement in the Scenario A case would call for an average real price of 18 mills per kilowatt hour, and would require external borrowings of $77.2 billion between now and 1990. If external funds were to reach 90% of all sources, the average price of electricity could be 15.3 mills per kilowatt hour, but borrowing requirements would be boosted to $103.4 billion. The lower price of electricity in the latter situation would come about because of the shift of part of the financial burden from present to future consumers of electricity. If the same rules applied to the Scenario C case, figure 5-2 shows that maintenance of the historical 70% dependence on external financing would produce borrowing requirements of $96 billion. Were borrowings used to gather 90% of the required funds, $124 billion would have to be found on domestic and foreign capital markets.

The range of external financial requirements which might be expected under our assumptions are shown for five year intervals in Table 5-2.

Figure 5-1. Scenario A — External financing requirements of the electric utilities (millions of $ 1975)

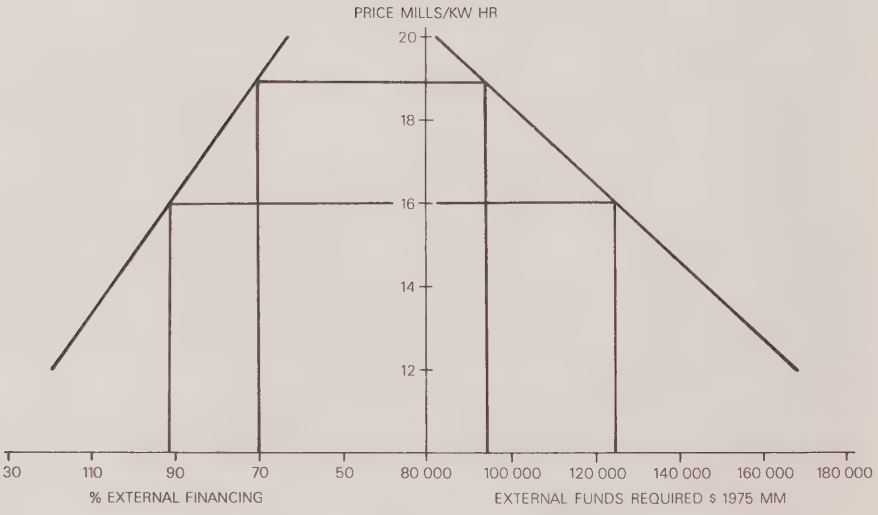


Figure 5-2. Scenario C — External financing requirements of the electric utilities (millions of $ 1975)

Table 5-2

Range of Estimated Financial Requirements of the Electric Utilities 1976-1990

(Millions of $ 1975)

Years	Scenario A		Scenario C	
	Minimum	Maximum	Minimum	Maximum
1976-80	13 900	18 600	17 300	22 300
1981-85	27 000	36 200	30 000	38 400
1985-90	36 300	48 600	48 700	63 300
Total	77 200	103 400	96 000	124 000

It is important to note that in both scenarios the percentage of external financing will not remain constant from one year to another, but will drift up over time. This is illustrated in the Figure 5-3 for the Scenario A case. The three lines in this chart represent the relation between price and external financial needs which would prevail in each of the years 1980, 1985, and 1990. In 1980 an average price of 16.8 mills would require external financing of only 72%, by 1980 this would climb to 82% and by 1990 it would be 93%. This produces an 80% reliance on external funds on average over the entire interval. This graph illustrates the interesting point that the real price of electricity will have to climb if the utilities are to maintain a stable ratio of external to internal financing over this period, and this will be true even if the initial price of electricity is quite high by present standards.

The need for prices to increase if external requirements are to remain constant in percentage terms is a direct result of the relatively high growth in capacity which is assumed. Additions to capacity call for immediate debt financing, but do not immediately raise sales or internal fund generation. Nor under present circumstances do they generate the cost-reducing economies of scale which permitted rapid capacity growth without increased reliance on external funds in the past. Thus, utilities are now forced to raise prices to meet incremental debt servicing requirements created by additions to capacity. Should the growth in capacity slow down sufficiently or stop altogether, this tendency would reverse itself, as a greater proportion of available internal funds could be used to service or retire existing debt.

The financial structure of utilities has in the past been almost irrelevant to their ability to raise funds. Provincial guarantees could overcome any weakness in the utilities' financial structure. However, even provincial guarantees are becoming inadequate in some cases to finance the most efficient type of expansion plan. American utilities, with their much more conservative financial structure, are experiencing such difficulties in raising funds that it would seem safe to say that if provincial guarantees are down-graded in the eyes of investors,

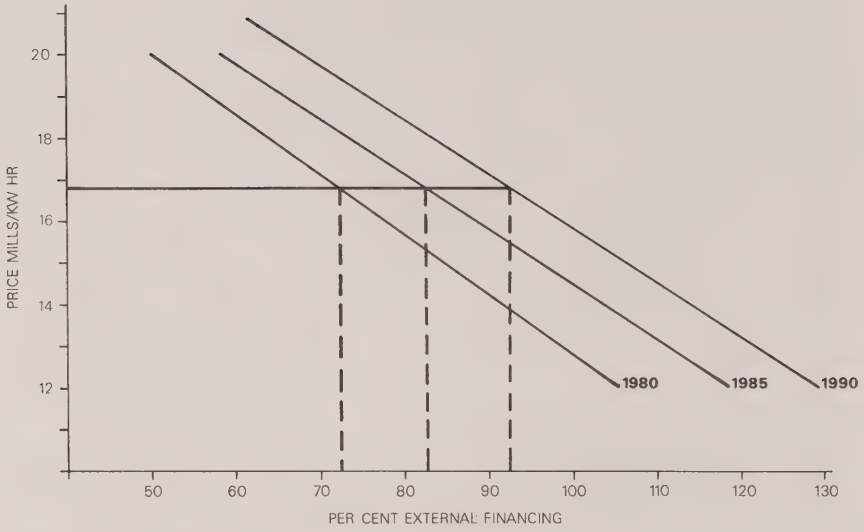


Figure 5-3. Scenario A — Relationship between price and external financing requirements over time

the relevant Canadian utilities would be hard pressed to obtain even a fraction of the funds they require.

This could lead to a very difficult situation. The provincial guarantee would still be regarded as good security for relatively small borrowings required to finance the construction of fossil-fueled stations, for example. This would put heavy pressure on utilities to opt for this kind of expansion path. Doing this might only worsen their financial problems, for over the long run an inefficient growth pattern cannot be easier to finance than an efficient one. If the same amount of power generated by a low capital cost fossil plant were sold at the same price as that from high capital cost nuclear or hydro plants, the cash earnings of the utility from the fossil plant would likely be lower over the long run because of its significantly higher operating costs. Ultimately the utility might be unable to finance any growth in generating capacity at all. The alternative would be to price electricity very much higher than what it would be in other regions, which is precisely what financially threatened utilities are at present attempting to avoid. This route could provide a sound financial base for the utility, but high cost electricity could place increasing demand on scarce fossil fuels.

In this new situation, it appears that the financing of electric utilties' investments will in the future have to be related much more closely to the economics of the projects themselves, as opposed to the credit rating of the provinces. If the expected profitability of a project is high enough and associated risks are reasonable, the financing of this project will obviously not present any

problems. On the other hand, if there is a high risk that the project contemplated might not generate enough revenues to cover the interest and principal payments on the debt required for its realization, private investors are likely to completely disregard the project or ask very high interest rates. It is under such circumstances that a joint federal-provincial equity participation for a portion of total cost, such as the proposed Maritime Energy Corporation, could play an important role. Such an approach could greatly facilitate the attraction of the needed debt capital at reasonable interest rates by transferring some of the risk to the government owners.

It is worth emphasizing here that the difficulties we address in this chapter do not have to persist over the long run. The problems are basically of a transitional nature and are due to the convergence of several adverse trends at once. At present the size of some utilities is small relative to the size of efficient additions to base load capacity. But as the utility grows this problem will decrease in relative importance. As more experience is gained with nuclear reactors, their real cost may stop increasing and may even decline. Finally, over the next 10 to 15 years, successful conservation efforts may reduce the rate of growth in capacity required by the utilities. All of these factors indicate that the problems faced by electric utilities are more or less transitional, but ignoring them could lead to suboptimal expansion paths over the next decade, and the unfortunate results of pursuing this course could persist far into the future.

The issue really is whether the tough financing problems will be handled now while they are still manageable, or whether they will be postponed and grow progressively worse as a result of each delay. The immediacy of this problem varies from one utility to another, but for some the time when postponement is no longer possible may not be far away.

Chapter 6. FINANCING THE ENERGY MINING INDUSTRIES

Coal mining

The coal mining industry in Canada can be divided into three distinct sectors: the eastern coal mining industry, which includes coking and thermal coal mining in Cape Breton and thermal coal mining in New Brunswick; the western thermal coal industry, which is composed of a number of mines in Alberta and Saskatchewan which mine lignite coal and subbituminous coal for electrical generation; and, the western coking coal industry which is made up of a small number of mines in the mountain regions of British Columbia and Alberta.

All sectors of the coal mining industry have undergone dramatic structural change in recent years. The principal mines in eastern Canada were taken over by crown corporations in the late sixties. Originally the western coal industry concentrated entirely on the production of thermal coal for use by electrical generating plants. Subsequently western coking coal mines were brought into production to meet a rise in world demand. The prospect of energy shortages has also served to create new interest in expanded development of thermal coal in western Canada.

Most coal mining developments will be undertaken by consortia composed of potential consumers who are attempting to assure supplies, and other companies with coal mining expertise. These projects will have nominal equity held by the major participants and they will be highly levered with conventional debt issues, consequently no special financing problems are expected for these industries. The total capital expenditures of roughly $3 billion predicted for coal and uranium mining to 1990 are not large when compared to total energy expenditures. This, however, could be dramatically revised if the demand for coal is intensified by new technology in coal utilization or if coal must replace other forms of energy.

Uranium mining

The development of uranium mining in Canada has had a cyclical history reflecting the rapid changes which have occurred in world demand. It now appears that nuclear energy is the cheapest and most reliable source of electrical generation available in many parts of the world. Demand for uranium as fuel for nuclear plants is accelerating. Consequently the major participants in the industry are not likely to encounter any serious difficulties in financing viable projects.

There are a number of conditions placed on the export of uranium to certain foreign countries. Nevertheless, a reasonably stable export market is developing

with good prospects for the future. There are regulations pertaining to foreign ownership of uranium mines in Canada which are intended to retain Canadian control of the industry in this country.

Mining infrastructure

The capital expenditures required for infrastructure are usually both enormous and essential to the development of either a uranium or a coal mine. Mines are usually developed in remote areas and thus require townsite facilities, transportation links, and port or terminal systems, particularly in the case of coal exports.

Uranium mining requires extensive investment in ore handling and processing and refining plants. New technological advances in coal or uranium may greatly add to their domestic conversion to energy and require large capital investments for the conversion systems.

The federal government, along with the provincial governments, is working toward new national policies which will be compatible with evolving requirements of these important industries.

Chapter 7. CONCLUSIONS

Summary

The analysis in this document—based on two plausible but quite different scenarios—indicates that Canadian energy developments are not likely to be hindered by widespread capital shortages. A basic problem relating to energy financing is uncertainty, and the energy industries appear at present to be in a dilemma: over-investment in high cost energy forms could be a burden, especially if prices fall; on the other hand avoiding such investments could lead them to "miss the boat" on future profitable investment opportunities.

Because of the long lead times required for energy development and because changes of fundamental importance can occur quickly and with little warning (the OPEC price increases are the best example), it is necessary to have a flexible policy framework which can moderate the disruptive effects of external shocks to the Canadian energy sector.

Some flexibility is already built into the system. For example, federal taxation of petroleum is such that higher capital expenditures lower the effective cost to the company of the investment through tax savings. On the electrical side, the federal government stands ready to assist in the cost of a first nuclear plant in any province and also to participate in transmission expenditures which promote regional interconnections. These policies have performed well. But, as the paper has emphasized, they may in future require modification as conditions change.

Recent events have shown the futility of trying to predict with great accuracy the future where energy is concerned. There is a need for continued government-industry dialogue to identify and cope with major problems in each sector as they arise. To this end, it would be useful to recapitulate briefly what are perceived to be the major problems in each sector.

Petroleum

The large petroleum firms are likely to generate cash flows sufficient to finance all of their projected investments. In addition, their strong cash flow position will enable them to borrow, should it be appropriate, to enhance the economics of oil sand or heavy oil projects by leveraging. The smaller firms, primarily Canadian owned, are not likely to enjoy the same availability of funds. The presence of Canadian content rules may enhance opportunities for these firms, but a lack of funds may still restrict their access to tar sands and frontier development.

The petroleum industry is faced with new challenges in the fields of unconventional oil and frontier development of both oil and gas. These will test its resourcefulness and may call for innovative approaches to financing. Governments may also have to tailor fiscal arrangements to the needs of individual projects. The industry will likely step up its diversification into non-petroleum areas, especially if frontiers or tertiary recovery are less profitable than had been hoped. A system of monitoring cash flows and capital expenditures, which is already in place, would provide adequate warning to government should this process impede national energy objectives.

Pipelines

This industry can be broken into two segments for the future. The first is the conventional pipeline industry in southern Canada. The second will involve the construction and operation of frontier pipelines. The financial conditions in each sector are so different that it is worth reviewing each separately.

Conventional pipelines

Capital expenditures in this sector will be to replace and expand existing lines, and in some cases to add new lines, such as the proposed system from Kitimat, British Columbia, to Edmonton. These are, by and large, financeable by normal methods, and no financial difficulties are anticipated.

Frontier pipelines

If the existing pipeline industry contributes significant equity for these lines, their future profitability will depend critically on performance of the systems. In certain circumstances, it may also be necessary for government to underwrite some of the risk. The majority of the investment, around 75%, will be financed by debt, most probably on a project financing basis. There is little doubt of the ability of domestic and foreign capital markets to absorb the required amount of debt if the terms are right, although it may be necessary to compensate debt holders for risks, for example, by allowing them to participate to some extent in the profits.

Electricity

The major problem relating to electricity financing seems to be that for the next 15 years the emphasis on remote hydro and nuclear growth will transform the risk characteristics of utility debt offerings. The bulk of incremental capacity will be very capital intensive, large-unit nuclear or hydro projects. The greater risks associated with these projects may require funding of a type more akin to equity than to debt. Since most Canadian utilities are crown corporations, equity is unlikely to be forthcoming from the private sector. This means there is likely to

be an increased role for an innovative financing role in the electrical sector over the medium term.

The problem is that at present the costs of efficiently sized generating units are very high relative to the financial capacity of some provinces and utilities. Related to this is the additional problem that efficient sized additions to capacity are very large in relation to existing load, so that errors in forecasting load growth can lead to under-utilization of capacity, with potentially serious financial effects. All of these risks are likely to decrease in importance over time. As more experience is gained, nuclear reactor construction costs are likely to fall in real terms and this tendency may be reinforced by technological breakthroughs. At the same time as these costs are falling, the financial capacity of the provinces and utilities will be growing, so that the relative importance of the additional financial strain due to constructing a new nuclear plant will decline. As the system grows, the percentage increase in capacity due to adding one efficient size nuclear station will be smaller, and this will minimize the percentage under-utilization which might occur from demand forecasts being in error.

In summary then, it appears that the federal government must stand ready to assist the provinces and utilities to adjust to a structural change in the electrical sector. However, once the adjustment is completed, the need for continued federal assistance will diminish. It is the next 10 to 15 years which will be the crucial period.

Macroeconomic and financial

The economy should be able to make the macroeconomic adjustments associated with increased energy investment over the next 15 years, though a need for careful stabilization and economic management policies is indicated if Canada is to avoid inflation and major production bottlenecks.

On the financing side, a definite reshuffling of financial priorities will occur. The energy industries will become proportionately larger borrowers than they have been in the past. Much of this financial shift will be facilitated by declining demands in other sectors, which will be brought about by normal structural changes in our economy, as well as by appropriate energy pricing policy. It would seem, therefore, that there is unlikely to be an absolute shortage of funds. However, the characteristics of available funds in some cases may not suit the uses for which they would be required.

It is anticipated that the normal process of intermediation both within the industry, as well as in financial markets, will serve to transform the characteristics of assets and liabilities so that they are acceptable to both borrowers and lenders. Should financial markets prove unable to undertake this process, it will be the role of government to intervene so as to ensure that the requisite financial transfers are effected as smoothly and efficiently as possible.